

**PROJECT MANUAL**

**ASTON TOWNSHIP MUNICIPAL COMPLEX**

*Bernardon Project No. 2301.00-22*

*March 29, 2024*

DREAM.  
DESIGN.  
SUCCEED.

## 1 SECTION 000100 - TABLE OF CONTENTS

2	Section.....Section Title	.....Pages
3	000100.....Table of Contents	6

## 4 DIVISION 00 – BIDDING REQUIREMENTS AND CONTRACT FORMS

5	000107.....Seals Page	2
6	001116.....Invitation to Bid	2
7	002113.....Instruction to Bidders Need info from Mel	11
8	002213.....Supplemental Instructions to Bidders	3
9	003113.....Preliminary Schedules	1
10	003132.....Geotechnical Data	6
11	004113.....Form of Proposal	4
12	004300.....Bid Bond	1
13	004315.....Consent of Surety	1
14	004320.....Hold Harmless Clause	1
15	004420.....Subcontractor List	1
16	004430.....Statement of Non-Collusion	1
17	004440.....Compliance Requirements	7
18	004445.....RACP Compliance Requirements	24
19	004450.....Wage Determination	10
20	004460.....Contractor's Qualification Statement	4
21	004470.....Financial Qualifications	4
22	006000.....Standard Form of Agreement Between Owner and Contractor	15
23	006005.....General Conditions of the Contract for Construction	43
24	006010.....Supplemental Conditions	6
25	006011.....Insurance	3
26	006100.....Partial Waiver of Lien to Date	1

## 27 DIVISION 01 - GENERAL REQUIREMENTS

28	011000.....Summary	5
29	011200.....Multiple Contract Summary	20
30	012300.....Alternates	2
31	012500.....Substitution Procedures	3
32	012600.....Contract Modification Procedures	2
33	012900.....Payment Procedures	4
34	013100.....Project Management and Coordination	7
35	013200.....Construction Progress Documentation	6
36	013300.....Submittal Procedures	10
37	014000.....Quality Requirements	7
38	014200.....References	3
39	015000.....Temporary Facilities and Controls	7
40	016000.....Product Requirements	5
41	017300.....Execution	8
42	017419.....Construction Waste Management and Recycling	6
43	017700.....Closeout Procedures	6
44	017823.....Operation and Maintenance Data	6
45	017839.....Project Record Documents	4
46	017900.....Demonstration and Training	4

47	DIVISION 03 – CONCRETE	
48	033000 .....Cast-In-Place Concrete	31
49	DIVISION 04 – MASONRY	
50	042200 .....Concrete Unit Masonry	10
51	047200 .....Cast Stone Masonry	9
52	DIVISION 5 - METALS	
53	051200 .....Structural Steel Framing	10
54	052100 .....Steel Joist Framing	5
55	053100 .....Steel Decking	7
56	054000 .....Cold-Formed Metal Framing	9
57	055000 .....Metal Fabrications	8
58	055113 .....Metal Pan Stairs	4
59	055213 .....Pipe and Tube Railings	4
60	DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES	
61	061000 .....Rough Carpentry	10
62	061053 .....Misc Rough Carpentry	4
63	061600 .....Sheathing	3
64	062013 .....Exterior Finish Carpentry	5
65	064113 .....Wood-Veneer-Faced Architectural Cabinets	10
66	064116 .....Plam-Faced Architectural Cabinets	7
67	064600 .....Wood Trim	5
68	DIVISION 07 – THERMAL AND MOISTURE PROTECTION	
69	071113 .....Bituminous Dampproofing	5
70	072100 .....Thermal Insulation	5
71	072119 .....Foamed-In-Place Insulation	3
72	072713 .....Mod Bit Sheet Air Barriers	8
73	072726 .....Fluid-Applied Membrane Air Barriers	7
74	074113.16 ....Standing-Seam Metal Roof Panels	14
75	074213.19 ....Insulated Metal Wall Panels	12
76	074113.23 ....Metal Composite Material Wall Panels	11
77	075323 .....EPDM Roofing	8
78	076200 .....Sheet Metal Flashing and Trim	10
79	077100 .....Roof Specialties	6
80	077233 .....Roof Hatches	5
81	077253 .....Snow Guards	4
82	078413 .....Penetration Firestopping	5
83	078443 .....Joint Firestopping	4
84	079200 .....Joint Sealants	12

85	DIVISION 8 – OPENINGS	
86	081113 .....Hollow Metal Doors and Frames	7
87	081416 .....Flush Wood Doors	6
88	083113 .....Access Doors and Frames	4
89	083463 .....Detention Doors and Frames	8
90	083613 .....Sectional Doors	8
91	084113 .....Aluminum Entrances and Storefronts	10
92	084413 .....Glazed Aluminum Curtain Walls	11
93	085653 .....Security Windows	11
94	087100 .....Door Hardware	32
95	088000 .....Glazing	10
96	088813 .....Fire-Rated Glazing	5
97	DIVISION 9 – FINISHES	
98	092216 .....Non-Structural Metal Framing	6
99	092900 .....Gypsum Board	8
100	093013 .....Ceramic Tiling	9
101	095113 .....Acoustical Panel Ceilings	6
102	096513 .....Resilient Base and Accessories	5
103	096519 .....Resilient Tile Flooring	5
104	096623 .....Resinous Matrix Terrazzo Flooring	11
105	096723 .....Resinous Flooring	5
106	096813 .....Tile Carpeting	5
107	099000 .....Painting and Coating	9
108	DIVISION 10 – SPECIALTIES	
109	101419 .....Dimensional Letter Signage	7
110	102113 .....Metal Toilet Compartments	5
111	102813 .....Toilet Accessories	5
112	104413 .....Fire Extinguisher Cabinets	4
113	104416 .....Fire Extinguishers	3
114	105113-02....Metal Personnel Lockers	5
115	105300 .....Cantilevered Canopies	4
116	DIVISION 11 – EQUIPMENT	
117	111916 .....Detention Gun Lockers	6
118	115313 .....Laboratory Fume Hoods	7
119	DIVISION 14 – CONVEYING SYSTEMS	
120	142400 .....Hydraulic Elevators	11



121	DIVISION 21 – FIRE SUPPRESSION	
122	210500 .....Standard Conditions for Fire Suppression	10
123	210513 .....Common Motor Requirements for Fire Suppression Equipment	2
124	210517 .....Sleeves And Sleeve Seals for Fire Suppression Piping	3
125	210518 .....Escutcheons for Fire Suppression Piping	2
126	210523 .....General Duty Valves for Fire Protection Piping	5
127	210553 .....Identification for Fire Suppression Piping and Equipment	4
128	211119 .....Fire Department Connections	2
129	211313 .....Wet Pipe Sprinkler Systems	12
130	DIVISION 22 – PLUMBING	
131	220500 .....Standard Conditions for Plumbing	13
132	220513 .....Common Motor Requirements for Plumbing Equipment	2
133	220517 .....Sleeves and Sleeve Seals for Plumbing Piping	3
134	220518 .....Escutcheons for Plumbing Piping	2
135	220519 .....Thermometers and Gauges for Plumbing	6
136	220523.12 ....Piping Ball Valves for Plumbing Piping	2
137	220523.14 ....Check Valves for Plumbing Piping	4
138	220529 .....Hangers And Supports for Plumbing Piping and Equipment	7
139	220553 .....Identification For Plumbing Piping and Equipment	3
140	220719 .....Plumbing Piping Insulation	12
141	221116 .....Domestic Water Piping	10
142	221119 .....Domestic Water Piping Specialties	8
143	221300 .....Drainage Systems	4
144	221316 .....Sanitary Waste and Vent Piping	7
145	221319.13 ....Sanitary Drains	3
146	221319 .....Sanitary Waste Piping Specialties	5
147	221323 .....Sanitary Waste Interceptors	3
148	221413 .....Facility Storm Drainage Piping	7
149	223300 .....Electric, Domestic Water Heaters	5
150	224000 .....Plumbing Fixtures and Equipment	5
151	DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	
152	230500 .....Standard Conditions for HVAC Work	13
153	230513 .....Common Motor Requirements for HVAC Equipment	3
154	230517 .....Sleeves and Sleeve Seals for HVAC Piping	3
155	230518 .....Escutcheons for HVAC Piping	2
156	230529 .....Hangers and Supports HVAC Piping & Equip	6
157	230548.13 ....Vibration Controls for HVAC	3
158	230550 .....Fire Stopping	6
159	230553 .....Identification for HVAC Piping and Equipment	5
160	230593 .....Testing, Balancing, and Adjusting	8
161	230713 .....Duct Insulation	13
162	230719 .....HVAC Piping Insulation	16
163	230933 .....Automatic Temperature Control	7
164	232300 .....Refrigerant Piping System	10

165	232316.....Apr Control (Rawal Valve)	3
166	232324.....Refrigerant Leak Detection System	3
167	233113.....Metal Ducts	10
168	233300.....Air Duct Accessories	11
169	233346.....Flexible Ducts	2
170	233713.13 ....Air Diffusers	5
171	233713.23 ....Registers and Grilles	2
172	233713.43 ....Security Registers and Grilles	3
173	237416.12 ....Packaged, Small-Capacity, Heat Pump Fired Rooftop Units (3-10 Tons)	7
174	237416.14 ....Packaged, Mid-Capacity, Heat Pump Rooftop Units (12.5-25 Tons)	8
175	238120.....Variable Refrigerant System	23
176	238127.....Ductless Split System (Single Zone R410A)	3
177	238333.....Electric Heaters and Heat Tracing	2
178	DIVISION 26 – ELECTRICAL	
179	260000.....Standard Conditions for Electrical Work	14
180	260526.....Grounding Systems: General	5
181	260900.....Lighting Controls	5
182	262416.....Panelboards	3
183	262700.....Basic Materials and Equipment – Comm Low	12
184	262816.....Safety Switches – General Duty	2
185	263000.....Emergency Ltg and Power System – Diesel	8
186	263623.....Automatic Transfer Switch	4
187	264313.....Surge Suppression	4
188	265000.....LED Lighting	4
189	266000.....Service and Distribution	3
190	DIVISION 27 – COMMUNICATIONS	
191	270526.....Grounding and Bonding for Communications	8
192	270528.....Low Voltage Conduit System (Telephone)	2
193	270528.36 ....Cable Trays for Communication Systems	8
194	270528.45 ....Telecommunications Flush Poke Thru	5
195	270528.48 ....Multimedia Connection Wall Box	4
196	2710 00.....Telecommunications Structured Cabling	39
197	274100.....Audiovisual Systems	34
198	274113.....Multimedia Systems Floorboxes	4
199	DIVISION 28 – ELECTRONIC SAFETY AND SECURITY	
200	281300.....Electronic Access Control	19
201	282300.....Video Surveillance Systems	17
202	283000.....Fire Alarm and Detection Systems – Address Horn	8
203	DIVISION 31 – EARTHWORK	
204	311000.....Site Clearing	6
205	312000.....Earth Moving	14

206	312301 .....	Excavation, Backfill and Compaction of Utilities	8
207	312319 .....	Dewatering	4
208	312500 .....	Sedimentation and Erosion Control Systems	4
209	321216 .....	Flexible Asphalt Paving	4
210	DIVISION 32 – EXTERIOR IMPROVEMENTS		
211	321313 .....	Concrete Paving	11
212	321373 .....	Concrete Paving Joint Sealants	6
213	321713 .....	Parking Bumpers	2
214	321723 .....	Pavement Markings	3
215	321726 .....	Tactile Warning Surfacing	6
216	329200 .....	Lawns, Grasses, and Exterior Plants	8
217	329300 .....	Plants	13
218	DIVISION 33 - UTILITIES		
219	330500 .....	Common Work Results for Utilities	10
220	331100 .....	Water Distribution	5
221	333100 .....	Sanitary Sewerage	5
222	334100 .....	Storm Drainage	5
223	334600 .....	Subdrainage	9
224	END OF SECTION 000100		

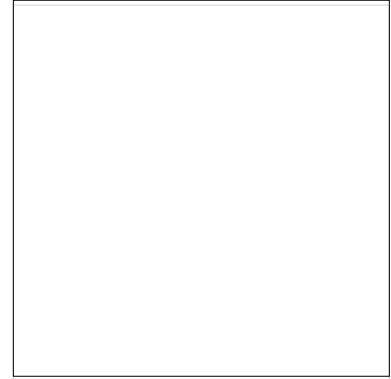
## DOCUMENT 000107 - SEALS PAGE

## 1.1 DESIGN PROFESSIONALS OF RECORD

## ARCHITECT

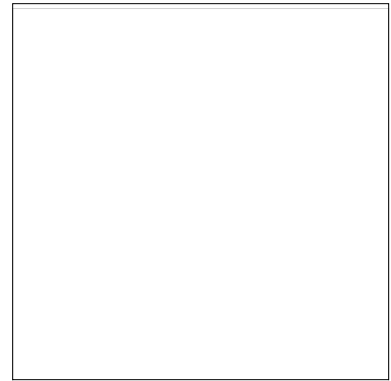
Bernardon

Divisions 01 – 14, except for sections noted  
in discipline below and in disciplines on each  
of the two pages that follow.

STRUCTURAL  
ENGINEER

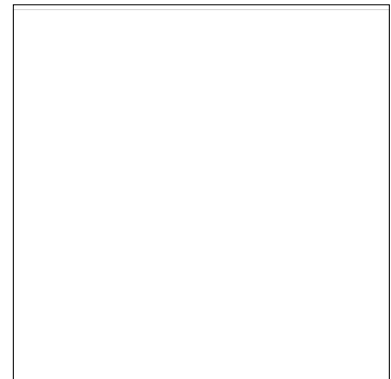
Baker, Ingram &amp; Associates

Section 033000  
Section 051200  
Section 052100  
Section 053100  
Section 054000

FIRE-  
PROTECTION  
ENGINEER

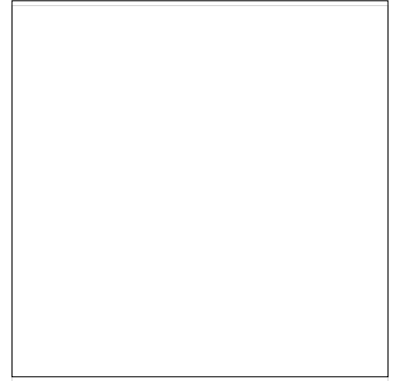
McHugh Engineering Associates, Inc.

Division 21



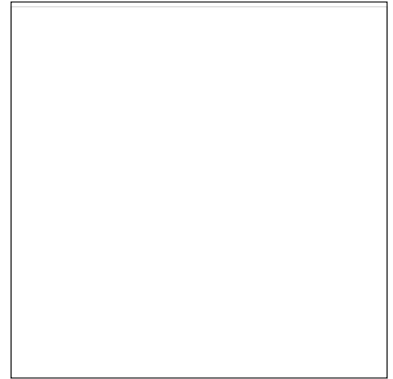
PLUMBING  
ENGINEER

McHugh Engineering Associates, Inc.  
Division 22



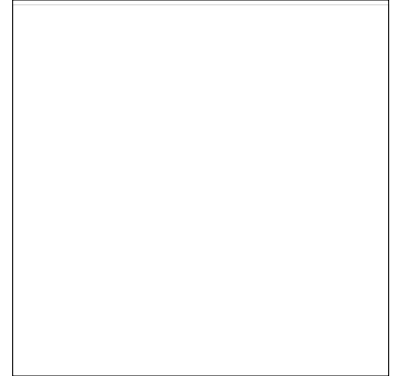
HVAC ENGINEER

McHugh Engineering Associates, Inc.  
Division 23



ELECTRICAL  
ENGINEER

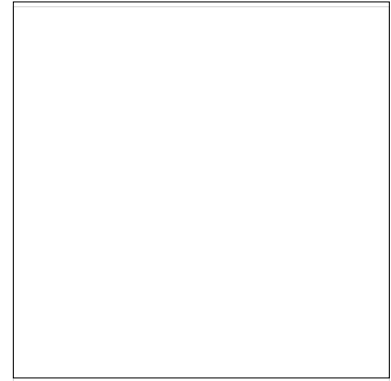
McHugh Engineering Associates, Inc.  
Division 26  
Division 27  
Division 28



IT/AV/SECURITY      Convergent Design Technologies Group

Division 27

Division 28

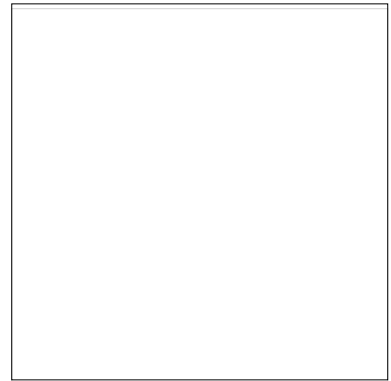


CIVIL ENGINEER      G. D. Houtman and Sons, Inc.

Division 31

Division 32

Division 33



END OF DOCUMENT 000107

DOCUMENT 001116 – INVITATION TO BID

Contractors are invited to submit SEALED BIDS for the bidding of the

**ASTON TOWNSHIP MUNICIPAL COMPLEX**

Bids are invited on a lump sum basis for the following construction contracts:

**Contract 1 – General Construction Contract**

**Contract 2 – Plumbing Construction Contract**

**Contract 3 – Mechanical Construction Contract**

**Contract 4 – Electrical Construction Contract**

**Contract 5 – Elevator Contract**

Aston Township hereby invites you to submit sealed bids for the Aston township Municipal Complex. Sealed bids will be received through PennBid™ by Aston Township for the Aston Township Municipal Complex 10:00 AM Eastern Standard Time on Tuesday, April 30, 2024. All documents and solicitation details will be made available Friday, March 29, 2024 at no cost at PennBid™ (<https://pennbid.bonfirehub.com>) and will be available online any time after the document release. Note, PennBid™ assesses a fee to the bidder who is issued the award. Click on “Open Public Opportunities”, and “View Opportunity” for the subject project.

Each bid must be accompanied by a certified check or bid bond payable to the Owner in an amount of not less than ten percent (10%) of the bid or bids. Only bonds from companies licensed to do business in the State where the Owner is located will be accepted and the bond shall so state same. Performance and Payment bonding will be required for the successful bidder.

Bids must be submitted unconditionally. No bidder may withdraw bid within SIXTY (60) days after the scheduled closing time for receipt of bids unless delayed due to required approvals of another governmental agency, sale of bonds, or the award of a grant or grants, in which case bids shall be irrevocable for one hundred twenty (120) days.

Aston Township reserves the right to waive any informalities, or to reject any or all bids.

Notice is hereby given that the Aston Township Municipal Complex for which construction proposals are being solicited is a construction project constructed by a public entity constituting public works and is subject to applicable provisions of the Pennsylvania Human Relations Act, the Pennsylvania Prevailing Wage Rates and other applicable Acts.

A mandatory Pre-Bid Conference is scheduled for 10:00 AM, on Thursday, April 4, 2024 at the Aston Township Community Center located at 3270 Concord Road, Aston, PA 19014. Please note, this is a mandatory Pre-Bid meeting. Private tours of the project site will not be conducted.

END OF DOCUMENT 001116

- 1 DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS
- 2 1.1 INSTRUCTIONS TO BIDDERS
- 3 A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting
- 4 Requirements by reference.
- 5 1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.
- 6 END OF DOCUMENT 002113





# AIA® Document A701® – 2018

## Instructions to Bidders

for the following Project:

*(Name, location, and detailed description)*

Aston Township Municipal Complex  
3264 Concord Road  
Aston, PA 19014

### THE OWNER:

*(Name, legal status, address, and other information)*

Aston Township  
2 New Road  
Aston, PA 19014

### THE ARCHITECT:

*(Name, legal status, address, and other information)*

Bernardon LLC  
10 North High Street  
Suite 310  
West Chester, PA 19380

### TABLE OF ARTICLES

1	DEFINITIONS
2	BIDDER'S REPRESENTATIONS
3	BIDDING DOCUMENTS
4	BIDDING PROCEDURES
5	CONSIDERATION OF BIDS
6	POST-BID INFORMATION
7	PERFORMANCE BOND AND PAYMENT BOND
8	ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

### ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

## **ARTICLE 1 DEFINITIONS**

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

## **ARTICLE 2 BIDDER'S REPRESENTATIONS**

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

## **ARTICLE 3 BIDDING DOCUMENTS**

### **§ 3.1 Distribution**

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)*

**§ 3.1.2** Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

**§ 3.1.3** Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

**§ 3.1.4** Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

**§ 3.1.5** The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

## **§ 3.2 Modification or Interpretation of Bidding Documents**

**§ 3.2.1** The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

**§ 3.2.2** Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)*

**§ 3.2.3** Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

## **§ 3.3 Substitutions**

**§ 3.3.1** The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

### **§ 3.3.2 Substitution Process**

**§ 3.3.2.1** Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

**§ 3.3.2.2** Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

**§ 3.3.2.3** If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

**§ 3.3.3** The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

**§ 3.3.4** If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

#### § 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)*

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

### ARTICLE 4 BIDDING PROCEDURES

#### § 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

#### § 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

*(Insert the form and amount of bid security.)*

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.



§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning days after the opening of Bids, withdraw its Bid and request the return of its bid security.

#### § 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

*(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)*

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

#### § 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

*(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)*

### ARTICLE 5 CONSIDERATION OF BIDS

#### § 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

## **§ 5.2 Rejection of Bids**

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

## **§ 5.3 Acceptance of Bid (Award)**

**§ 5.3.1** It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

**§ 5.3.2** Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

## **ARTICLE 6 POST-BID INFORMATION**

### **§ 6.1 Contractor's Qualification Statement**

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

### **§ 6.2 Owner's Financial Capability**

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

### **§ 6.3 Submittals**

**§ 6.3.1** After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

**§ 6.3.2** The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

**§ 6.3.3** Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

**§ 6.3.4** Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

## **ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND**

### **§ 7.1 Bond Requirements**

**§ 7.1.1** If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

*(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)*

## § 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

## ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.  
*(Insert the complete AIA Document number, including year, and Document title.)*

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.  
*(Insert the complete AIA Document number, including year, and Document title.)*

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.  
*(Insert the complete AIA Document number, including year, and Document title.)*

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:  
*(Insert the date of the E203-2013.)*

.5 Drawings

Number	Title	Date	
.6	Specifications		
Section	Title	Date	Pages

.7 Addenda:

Number	Date	Pages
--------	------	-------

.8 Other Exhibits:

*(Check all boxes that apply and include appropriate information identifying the exhibit where required.)*

☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:  
*(Insert the date of the E204-2017.)*

☐ The Sustainability Plan:

Title	Date	Pages
-------	------	-------

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents listed below:

*(List here any additional documents that are intended to form part of the Proposed Contract Documents.)*



# **Additions and Deletions Report for**

## **AIA® Document A701® – 2018**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 14:13:28 ET on 03/28/2024.

### **PAGE 1**

Aston Township Municipal Complex  
3264 Concord Road  
Aston, PA 19014

...

Aston Township  
2 New Road  
Aston, PA 19014

...

Bernardon LLC  
10 North High Street  
Suite 310  
West Chester, PA 19380

## ***Certification of Document's Authenticity***

***AIA® Document D401™ – 2003***

I, \_\_\_\_\_, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 14:13:28 ET on 03/28/2024 under Order No. 3104239930 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ – 2018, Instructions to Bidders, other than those additions and deletions shown in the associated Additions and Deletions Report.

\_\_\_\_\_  
*(Signed)*

\_\_\_\_\_  
*(Title)*

\_\_\_\_\_  
*(Dated)*

## DOCUMENT 002213 – SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

The following supplements modify, change, delete from, or add to the “Instructions to Bidders”, AIA Document A701 – 2018. Where any article of the “Instructions to Bidders” is modified or any paragraph, subparagraph, or clause thereof is modified or deleted by these Supplemental Instructions, the unaltered provisions of that article, paragraph, subparagraph or clause shall remain in effect.

ARTICLE 3 – BIDDING DOCUMENTS:

Change the first sentence of paragraph 3.1.1 to read as follows:

3.1.1 Bidding documents and solicitation details will be made available Friday, March 29, 2024 at no cost at PennBid™ (<https://pennbid.bonfirehub.com>) and will be available online any time after the document release. Note, PennBID™ assesses a fee to the bidder who is issued the award. Click on “Open Public Opportunities”, and “View Opportunity” for the subject project.

One set of documents will be available for public inspection in the Administration department at the Aston Township building located at 2 New Road, Aston, PA 19014 between the hours of 9:30 AM and 4:00 PM, Monday through Friday. That set of documents is not to be removed from the building, and office personnel WILL NOT make copies of any portion of the package for your convenience.

Sub-contractors are invited to obtain sets of drawings through PennBid™ ([www.ebidexchange.com](http://www.ebidexchange.com)\PennBID.net). The Architect and Aston Township do NOT make any assurance that all Prime Contractors are known prior to bid date. Addenda will be issued via PennBid™ and can be accessed anytime following the posting of addenda. Note, PennBID™ assesses a fee to the bidder who is issued the award. Click on the “Solicitations” and “View” tabs.

Prime Contractors shall be responsible for communicating addenda to sub-contractors.

Change paragraph 3.2.2 to read as follows:

3.2.2 Prospective bidders of the Prime Contracts requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of bids. Sub-bidders requiring clarification shall make their request for clarification through the prospective bidders of the Prime Contracts.

Add the following subparagraph to paragraph 3.2.2:

3.2.2.1 Questions shall be submitted through PennBid™ ([www.ebidexchange.com](http://www.ebidexchange.com)\PennBID.net).

1 ARTICLE 4 – BIDDING PROCEDURES:

2 Add the following subparagraph to paragraph 4.2.1:

- 3 4.2.1.1 Each bid shall be accompanied by a certified check or bank cashier's check or Bid Bond payable to  
4 Aston Township in an amount of not less than ten percent (10%) of the amount of the Base Bid.

5 Add the following subparagraph to paragraph 4.2.2:

- 6 4.2.2.1 Surety company must be licensed in the Commonwealth of Pennsylvania.

7 Add new paragraph 4.2.5:

- 8 4.2.5 Additional Bid Material: The following documents shall be included with the Bid and completed in  
9 their entirety:  
10 .1 Form of Proposal (Document 004113).  
11 .2 Bid Bond or certified check or cashier's check (Document 004300).  
12 .2 Consent of Surety (Document 004315).  
13 .4 Hold Harmless Clause (Document 004320).  
14 .5 Subcontractor List (Document 004420).  
15 .6 Statement of Non-Collusion (Document 004430).  
16 .7 Compliance Requirements (Document 004440).  
17 .8 RACP Compliance Requirements (Document 004445).  
18 .9 Contractor's Qualification Statement (Document 004460).

19 Add the following subparagraph to paragraph 4.3.1:

- 20 4.3.1.1 All copies of the Bid, the bid security, and any other documents required to be submitted with the bid  
21 shall be submitted through PennBid™ ([www.ebidexchange.com/PennBID.net](http://www.ebidexchange.com/PennBID.net)).

22 Change paragraph 4.4.1 to read as follows:

- 23 4.4.1 Bids must be submitted unconditionally. No bidder may withdraw bid within SIXTY (60) days after  
24 the scheduled closing time for receipt of bids unless delayed due to required approvals of another  
25 governmental agency, sale of bonds, or the award of a grant or grants, in which case bids shall be  
26 irrevocable for one hundred twenty (120) days.

27 ARTICLE 6 – POST-BID INFORMATION:

28 Delete paragraph 6.1, "Contractor's Qualifications Statement" in its entirety.

29 Delete paragraph 6.2, "Owner's Financial Capability" in its entirety.

30 Change paragraph 6.3.1 to read as follows:

- 31 6.3.1 The Bidder shall, within 7 calendar days after notification of selection for the award of a contract,  
32 furnish to the Owner through the Construction Manager in writing the following information:  
33 .1 Performance Bond (Use AIA Document A-312 or similar; cost is to be included in the Bid).  
34 .2 Payment Bond (Use AIA Document A-312 or similar; cost is to be included in the Bid)  
35 .3 Bar chart schedule for work of the prime contract.

1 ARTICLE 7 – PERFORMANCE BOND AND PAYMENT BOND:

2 Add the following subparagraph to paragraph 7.1.1:

3 7.1.1.1 Performance Bond and Labor and Material Payment Bond, both in the amount of 100% of the Contract  
4 Sum, are required.

5 Add the following Article 9:

6 ARTICLE 9 – MISCELLANEOUS PROVISIONS

7 9.1 – STIPULATION FOR PARTIAL WAIVER OF LIEN TO DATE

8 9.1.1A Stipulation, in approved form, is required specifying that no mechanic's lien or other liens shall be  
9 filed against the building by Contractors, Subcontractors, or material suppliers, for work done or  
10 materials furnished in fulfillment of the Contract. The executed Stipulation For Partial Waiver of Lien  
11 To Date (Document 006100 – Partial Waiver of Lien to Date) shall be submitted with each completed  
12 Application for Payment.

13 9.2 – PRE-BID CONFERENCE

14 9.2.1 A mandatory Pre-Bid Conference will be held at the time and place designated in the Invitation to Bid.  
15 Attendance by Bidders is mandatory. Prospective bidders are strongly encouraged to attend. Private  
16 tours of the project site will not be conducted.

17 END OF DOCUMENT 002213

## 1 DOCUMENT 003113 - PRELIMINARY SCHEDULES

## 2 1.1 PROJECT SCHEDULE

3 A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements  
4 for the Project. They provide Owner's information for Bidders' convenience and are intended to  
5 supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders'  
6 convenience and information, but do not affect Contract Time requirements. This Document and its  
7 attachments are not part of the Contract Documents.

8 B. Available Project information includes the following:

9 1. Project Schedule.

10 C. Project schedule including design and construction milestones and Owner's occupancy requirements are  
11 as follows:

12 1. Commence site mobilization no later than June 12, 2024.

13 2. Temporary power panel on site by June 26, 2024.

14 3. Temporary power (main feed and poles) to the trailers must be completed by August 5, 2024.

15 4. Commence active construction no later than August 5, 2024.

16 5. Complete submission of all required submittals no later than October 25, 2024.

17 6. Achieve Substantial Completion no later than August 13, 2025.

18 7. Achieve Final Completion no later than September 9, 2025.

19 D. Related Requirements:

20 1. Document 004113 Form of Proposal for Contract Time.

21 2. Section 011000 "Summary" for phased construction requirements.

22 3. Section 013200 "Construction Progress Documentation" for Contractor's construction schedule  
23 requirements.

24 END OF DOCUMENT 003113

DOCUMENT 004113 – FORM OF PROPOSAL

**BID PROPOSAL FORM**

**for**

**ASTON TOWNSHIP MUNICIPAL COMPLEX**

Deliver this Form of Proposal to:

All copies of the Bid, the bid security, and any other documents required to be submitted with the bid shall be submitted through PennBid™ (<https://pennbid.bonfirehub.com>).

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply.

**1.2 SUMMARY**

- A. Related Sections include the following:

1. Section 012200 “Unit Prices” for the descriptions of unit prices.
2. Section 012300 “Alternates” for the descriptions of alternates.

**1.3 CONTRACT NAME**

- A. Contract No. Proposed (check contract that applies; if bidding more than one contract, submit separate bid forms for each contract):

☐ Contract 1 – General Construction Contract

☐ Contract 2 – Plumbing Construction Contract

☐ Contract 3 – Mechanical Construction Contract

☐ Contract 4 – Electrical Construction Contract

☐ Contract 5 – Elevator Construction Contract

## 1 BASE BID

- 2 B. Base Bid: The undersigned Bidder, having carefully examined the Procurement and Contracting  
3 Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as  
4 prepared by Bernardon and Architect's consultants, having visited the site, and being familiar with all  
5 conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and  
6 services, including all scheduled allowances, necessary to complete the construction of the above-named  
7 project, according to the requirements of the Procurement and Contracting Documents, for the stipulated  
8 sum of:

9 Base Bid for \_\_\_\_\_  
10 Contract Name

11 \_\_\_\_\_ Dollars (\$ \_\_\_\_\_)

## 12 1.4 UNIT PRICES

- 13 A. The undersigned Bidder, agree, if awarded the Contract to perform additional work or to delete work at  
14 the Unit Prices set forth below or at a negotiated unit price (Unit Prices are for work that is in addition to  
15 or is deleted from the base bid work):

- 16 1. Unit Price No.GC-01: Removal of unsatisfactory soil and replacement with satisfactory soil  
17 material.

18 \$ \_\_\_\_\_ per cu. yd.

- 19 2. Unit Price No. GC-02: Miscellaneous and structural steel.

20 \$ \_\_\_\_\_ per pound

## 21 1.5 ALTERNATES

- 22 A. Alternate No. GC-01: RACP Compliance Requirements

23 \_\_\_\_\_ Dollars \$ \_\_\_\_\_

24 Alternate No. GC-02: Vehicle Shelter

25 \_\_\_\_\_ Dollars \$ \_\_\_\_\_

26 Alternate No. GC-03: Scope of Elevator Construction Contract

27 \_\_\_\_\_ Dollars \$ \_\_\_\_\_

28 Elevator Subcontractor: \_\_\_\_\_

29 Manufacturer of Elevator: \_\_\_\_\_

30 Alternate No. PC-01: RACP Compliance Requirements

31 \_\_\_\_\_ Dollars \$ \_\_\_\_\_

32 Alternate No. MC-01: RACP Compliance Requirements

33 \_\_\_\_\_ Dollars \$ \_\_\_\_\_



Alternate No. EC-01: RACP Compliance Requirements

Dollars \$ \_\_\_\_\_

Alternate No. EC-02: Vehicle Shelter

Dollars \$ \_\_\_\_\_

1.6 AGREEMENT

- A. We, the Undersigned, agree, if awarded the contract for the project, to execute an agreement for the above stated work and compensation on Form of Agreement Between Owner and Contractor, Standard AIA Form A101-2017 Edition.

1.7 STATEMENT

- A. In submitting this bid, it is understood that the right is reserved by the Owner to reject any and/or all bids and waive all informalities therein.

- B. We, the Undersigned, acting through its authorized officers and intending to be legally bound, agree that this bid proposal shall constitute an offer by the Undersigned to enter into a Contract with the acts and things therein provided, which offer shall be irrevocable for sixty (60) calendar days from the date of opening hereof and that the Owner may accept this offer at any time during said period by notifying the Undersigned of the acceptance of said offer.

- C. The following documents are attached and made a condition of this Bid:

- 1.) Bid Bond or certified check or cashier's check (Document 004300).
- 2.) Consent of Surety (Document 004315).
- 3.) Hold Harmless Clause (Document 004320).
- 4.) Subcontractor List (Document 004420).
- 5.) Statement of Non-Collusion (Document 004430).
- 6.) Compliance Requirements (Document 004440).
- 7.) RACP Compliance Requirements (Document 004445).
- 8.) Contractor's Qualification Statement (Document 004460).

- D. We, the Undersigned, acknowledge receipt of the following Addenda:

Addenda Number	Dated
_____	_____
_____	_____
_____	_____
_____	_____

- E. The Undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

F. A Bid Bond in the amount of ten percent (10%) of this total must be submitted with your bid. A Performance Bond and a Labor and Materials Bond equaling one hundred percent (100%) of the total award must be provided by the selected Contractor within seven (7) days of the award.

G. Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver Insurance Certificates, required by the Contract Documents.

Company Name:

\_\_\_\_\_

Submitted by:

\_\_\_\_\_

Title:

\_\_\_\_\_

Bidder is (an)

\_\_\_\_\_

(Individual) (Partnership) (Corporation)

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 004113

DOCUMENT 004300 – BID BOND

**THE OWNER HAS PROVIDED THIS SAMPLE BID BOND  
FOR SUBMISSION TO A BIDDER'S INSURANCE/BONDING COMPANY.  
LANGUAGE SUCH AS THIS WILL BE ACCEPTED; HOWEVER, LANGUAGE  
THAT LIMITS THE BID BOND TO THE "DIFFERENCE" BETWEEN  
BID AMOUNT AND SUCH LARGER AMOUNT FOR WHICH THE OWNER  
COULD CONTRACT, SHALL NOT BE ACCEPTABLE.**

THIS BOND, made this \_\_\_\_\_ day of \_\_\_\_\_, 2024.

WITNESSETH:

KNOW ALL MEN BY THESE PRESENT, that we, the undersigned,

\_\_\_\_\_, as Principal and

\_\_\_\_\_, as  
Surety, are held firmly bound unto Aston Township, as Owner, in the sum of Ten Percent (10%) of Amount of Bid,  
for the payment of which we hereby jointly and severally bind ourselves, our heirs, executors, administrators,  
successors and assigns.

The condition of the above is such that whereas the Principal has submitted to Aston Township a certain Bid,  
attached hereto and hereby made a part hereof to enter into a contract in writing for

\_\_\_\_\_.

NOW, THEREFORE,

(a) If said Bid be rejected, or in the alternate,

(b) If said Bid shall be accepted and the Principal shall execute and deliver a contract in the Form of  
Agreement attached hereto (properly completed in accordance with said Bid), and shall in all other  
respects perform the agreement created by the acceptance of said Bid,

Then this obligation shall be null and void; otherwise the same shall remain in full force and effect; it being  
expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event  
exceed the amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligation of said Surety and its bond shall in no  
way be impaired or affected by an extension of the time within which the Owner may accept such bid; and said  
Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the **Principal and the surety** have hereunto set their hands and seals, and in such of  
them as are corporations have caused their corporate seals to be hereto affixed and those present to be signed by  
their proper officers, the day and year first set forth above.

by Principal: \_\_\_\_\_ by Surety: \_\_\_\_\_

END OF DOCUMENT 004300

DOCUMENT 004315 – CONSENT OF SURETY

**CONSENT (OR AGREEMENT) OF SURETY**

The undersigned [\_\_\_\_\_, a corporation organized and existing under  
Name of Surety Co.

the laws of the State of \_\_\_\_\_ and authorized to do business in the Commonwealth of  
Pennsylvania, does hereby consent and agree with

**Aston Township**

that if the proposal of \_\_\_\_\_ for  
Name of Bidder

\_\_\_\_\_  
Title and Name of Bid

be accepted and a contract for said work be awarded to the said (\_\_\_\_\_),  
Name of Bidder

it will, upon its being so awarded, become surety for the said (\_\_\_\_\_) on  
Name of Bidder  
such surety bonds as are called for in the Request for Bids.

Signed and Sealed (\_\_\_\_\_)  
Date

Name of Surety Co.

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

Attorney-in-fact

**POWER OF ATTORNEY MUST BE ATTACHED TO CONSENT OF SURETY**

YOU MUST PROVIDE BELOW THE NAME, ADDRESS AND PHONE NUMBER OF A PERSON TO BE  
CONTACTED IN THE EVENT ANY QUESTIONS OR CLAIMS ARISE REGARDING THE BID AND/OR  
PERFORMANCE BOND.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

ADDRESS \_\_\_\_\_

PHONE # \_\_\_\_\_

END OF DOCUMENT 004315

## DOCUMENT 004320 – HOLD HARMLESS CLAUSE

**HOLD HARMLESS CLAUSE**

- A. The contractor shall indemnify and save harmless Aston Township, their elected and appointed officers, consultants, agents and employees, including its individual members, the Architect and the Architect's consultants, agents and employees (hereinafter "Indemnitees") from and against all losses, claims, demands, payments, suits, actions, recoveries, expenses, including attorneys' fees and judgments of every nature and description brought against or recoverable from the Indemnitees, by reason of any act or omission of the contractor, a subcontractor, their agents, employees, assigns, and any entity acting in the contractor's behalf and on the contractor's direction in the execution of any work and any activities directly or indirectly incidental thereto. This specifically includes any negligence or carelessness of the contractor in failing to review all plans, specifications, and other documents published by the Indemnitees in connection with the preparation and award of the contract.
- B. The contractor shall assume all risk and bear any loss or injury to the property or any person which is caused by the negligence of the contractor, including his negligent failure to notify Aston Township, their elected and appointed officers, consultants, agents and employees, including their individual members, or any dangerous condition requiring Aston Township, their elected and appointed officers, consultants, agents and employees, including their individual members, action, during the period including periods when the contractor is not present on the site but during the progress of the work provided for in the contract until the same shall have been completed and accepted. The contractor shall also assume all responsibility for any and all loss by reason of the contractor's negligence or violation of any local, state, or federal law, regulation, practice, or order. The contractor shall give to Aston Township and all other appropriate authorities all required notices relating to the work for which the contract was let including all notices of any dangerous conditions.
- C. The contractor, in executing this Agreement, represents to Aston Township, their elected and appointed officers, consultants, agents and employees, including their individual members, that the contents of this hold harmless clause has been communicated to any subcontractors or employees and that this representation is made in behalf of both him/herself and all persons or organizations acting in the contractors' behalf including any subcontractors.
- D. The obligation to indemnify under this section for any claims against any Indemnatee by an employee of the contractor, a subcontractor or anyone directly or indirectly employed by them or anyone for whose acts they may be liable shall not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for the contractor or a subcontractor under workers' compensation laws, disability benefit acts or other employee benefit statutes.

ATTEST:

\_\_\_\_\_  
Name of Firm\_\_\_\_\_  
Witness\_\_\_\_\_  
Signature\_\_\_\_\_  
Please Print Name

END OF DOCUMENT 004320

## 1 DOCUMENT 004420 – SUBCONTRACTOR LIST

- 2 List all subcontractors to be used on this project. BIDDERS MAY REPRODUCE THIS SECTION AS REQUIRED  
3 TO PROVIDE A COMPLETE LIST OF SUBCONTRACTORS. Any subcontractor trades not listed below are as-  
4 sumed to be performing work as personnel directly on the General Contractor's employment role.

<u>Subcontractor Category</u>	<u>Name of Subcontractor</u>	<u>Address (City and State)</u>
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		

## 5 END OF DOCUMENT 004420

## 1 DOCUMENT 004430 – STATEMENT OF NON-COLLUSION

2 This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement,  
3 participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with  
4 this proposal submitted this date to Aston Township.

5 All the terms and conditions of the Aston Township Municipal Complex have been thoroughly examined and are  
6 understood.

7 **NAME OF BIDDER:**

8 \_\_\_\_\_

9 **AUTHORIZED REPRESENTATIVE**

10 (Typed):

11 \_\_\_\_\_

12 **AUTHORIZED REPRESENTATIVE**

13 (Signature):

14 \_\_\_\_\_

15 **TITLE:**

16 \_\_\_\_\_

17 **ADDRESS OF BIDDER:**

18 \_\_\_\_\_

19 \_\_\_\_\_

20 \_\_\_\_\_

21 **PHONE NUMBER:**

22 \_\_\_\_\_

23 Sworn to and Subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_ 2018.

24 My Commission expires \_\_\_\_\_ . NOTARY PUBLIC \_\_\_\_\_ .

25 **THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED**

26 END OF DOCUMENT 004430

## DOCUMENT 004440 – COMPLIANCE REQUIREMENTS

The construction contractor (“Contractor”) and its subcontractors recognize that compliance with these requirements is mandated for the performance of this construction contract (“Contract”). These requirements will be included in the Aston Township’s contract with the Prime Contractors; and this document, Document 004440 – Compliance Requirements, will be included as an attachment to the Standard Form of Agreement Between Owner and Contractor.

It shall be the sole responsibility of the Contractor to investigate and determine the applicability of any and all federal statutes, Pennsylvania statutes, local ordinances, rules, regulations, etc., as they affect and impact upon this project and to take all necessary steps to assure the Contractor’s compliance with the aforementioned requirements. It is specifically stipulated and agreed by and between the Owner and the Contractor that no liability or responsibility whatsoever will attach to the Owner, Architect, or Engineer in the event of non-compliance with any federal statute, state statute, local ordinance, rule, regulation, etc.

## 1.1 COMPLIANCE REQUIREMENTS:

1. Contractor shall comply with all applicable federal, state, local, Owner and industry statutes, regulations, ordinances, codes, resolutions, policies, procedures and standards. The failure to specifically reference or include said matters in the Contract Documents does not excuse Contractor from compliance with same.
2. All Contractors and their subcontractors are required to be registered with the local township or municipality and Contractors and their subcontractors are required to pay any registration or licensing fees as required by that Township.

I am aware of the Compliance Requirements, and I certify that to the best of my knowledge the Aston Township Municipal Complex will meet all of these requirements.

**ATTEST:**

---

  
Title

---

  
Title

---

  
Date

---

  
Date

Sworn to and Subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_ 2024.

My Commission expires \_\_\_\_\_. NOTARY PUBLIC \_\_\_\_\_.

**THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED**



1.2 COMPLIANCE WITH GOVERNING LAWS, RESOURCES, POLICIES, PROCEDURES AND REGULATIONS:

A. The Bidder's attention is directed to the fact that all applicable Federal and State laws, county and municipal ordinances and codes, and Owner policies, resolutions and procedures and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Agreement whether expressly set forth therein or otherwise. The following paragraphs B through O are deemed to be included in the Agreement, the same as though therein written in full.

B. FEDERAL OCCUPATIONAL SAFETY & HEALTH ACT OF 1970 (O.S.H.A.):

1. The Contractor is required to promptly perform all reporting and recording as required by said Act.

C. PENNSYLVANIA ACT 287 - UTILITIES PROTECTION:

1. The Contractor will be responsible for complying with Pennsylvania Act 287 of 1974, as amended, commonly known as the "CALL BEFORE YOU DIG ACT". Excavation or digging Contractors may learn the utilities and authority Owners by calling 1-800-242-1776 statewide prior to work. One call locates utility lines and the utilities are notified.

D. COMPLIANCE WITH HUMAN RELATIONS ACT:

1. The provisions of the Pennsylvania Human Relations Act, Act 222 of October 27, 1955 (P.L. 744) (43 P.S. Section 951, et. seq.) of the Commonwealth of Pennsylvania prohibit discrimination because of race, color, familial status, religious creed, ancestry, age, sex, national origin, handicap, disability or use of guide or support animal, by employers, employment agencies, labor organizations, contractors, and others. The Contractor agrees to comply with the provisions of this Act as amended and said Act is made part of the Contract Documents. Your attention is directed to the language of the Commonwealth's non-discrimination clause in 16 PA. Code 49.101.

E. PENNSYLVANIA PREVAILING WAGE ACT 442:

1. The general prevailing minimum wage rates including contributions for employee's benefits as shall have been determined by the Secretary of Labor and Industry which must be paid to the workmen employed in the performance of the Contract.

a. The Contract shall specifically provide that the Contractor shall pay no less than the wage rates as determined in the decision of the Secretary of Labor and Industry and shall comply with the conditions of the Pennsylvania Prevailing Wage Act approved August 15, 1961 (Act No. 442), as amended August 9, 1963 (Act No. 342), and the Regulations issued pursuant thereto, to assure the full and proper payment of said rates.

b. The contract shall contain the stipulation that such workmen shall be paid no less than such general prevailing minimum wage rates and such other provisions to assure payment thereof, as heretofore set forth in Section 9.103 of Title 34 of the Pennsylvania Administrative Code.

c. The contract provisions shall apply to all work performed on the contract by the Contractor and to all work performed on the contract by all subcontractors.

d. The Contractor shall insert in each of his sub-contracts all of the stipulations contained in these required provisions and such other stipulations as may be required.

e. The Contract shall provide that no workmen may be employed on the public work except in accordance with the classifications set forth in the decision of the Secretary. In the event that additional or different classifications are necessary, the procedure set forth in Section 9.107 of Title 34 of the Pennsylvania Administrative Code shall be followed.

- 1 f. The Contract shall provide that all workmen employed or working on the public work shall  
2 be paid unconditionally, regardless of whether any contractual relationship exists or the  
3 nature of any contractual relationship which may be alleged to exist between any  
4 contractor, subcontractor and workmen, not less than once a week without deduction or  
5 rebate, on any account, either directly or indirectly, except authorized deductions, the full  
6 amounts due at the time of payment, computed at the rates applicable to the time worked in  
7 the appropriate classification. Nothing in the contract, the Act or Title 34 of the  
8 Pennsylvania Administrative Code shall prohibit the payment of more than the general  
9 prevailing minimum wage rates as determined by the Secretary to any workman on public  
10 work.
- 11 g. The Contract shall provide that the Contractor and each subcontractor shall post for the  
12 entire period of construction the wage determination decisions of the Secretary, including  
13 the effective date of any changes thereof, in a prominent and easily accessible place or  
14 places at the site of the work and at such place or places used by them to pay workmen  
15 their wages. The posted notice of wage rates must contain the following information:
- 16 1) Name of project.
  - 17 2) Name of public body of which it is being constructed.
  - 18 3) The crafts and classifications of workmen listed in the Secretary's general prevailing  
19 minimum wage rate determination for the particular project.
  - 20 4) The general prevailing minimum wage rates determined for each craft and  
21 classification and the effective date of any changes.
  - 22 5) A statement advising workmen that if they have been paid less than the general  
23 prevailing minimum wage rate for their job classification or that the Contractor  
24 and/or subcontractor are not complying with the Act or Title 34 of the Pennsylvania  
25 Administrative Code in any manner whatsoever they may file a protest in writing  
26 with the Secretary of Labor and Industry within three (3) months of the date of the  
27 occurrence, objecting to the payment to any Contractor to the extent of the amount  
28 or amounts due or to become due to them as wages for work performed on the  
29 public work project. Any workmen paid less than the rate specified in the contract  
30 shall have a civil right of action for the difference between the wage paid and the  
31 wages stipulated in the contract, which right of action must be exercised within six  
32 (6) months from the occurrence of the event creating such right.
- 33 h. The Contract shall provide that the Contractor and all subcontractors shall keep an accurate  
34 record showing the name, craft and/or classification, number of hours worked per day, and  
35 the actual hourly rate of wage paid (including employee benefits) to each workman  
36 employed by him in connection with the public work and such record must include any  
37 deductions from each workman. The record shall be preserved for two years from the date  
38 of payment and shall be open at all reasonable hours to the inspection of the public body  
39 awarding the contract and to the Secretary of Labor and Industry or his duly authorized  
40 representatives.
- 41 i. The Contract shall provide that apprentices shall be limited to such numbers as shall be in  
42 accordance with a bona fide apprenticeship program registered with and approved by the  
43 Pennsylvania Apprenticeship and Training Council and only apprentices whose training  
44 and employment are in full compliance with the provisions of the Apprenticeship and  
45 Training Act approved July 14, 1961 (Act No. 304) and the Rules and Regulations issued  
46 pursuant thereto shall be employed on the public work project. Any workman using the  
47 tools of a craft who does not qualify as an apprentice within the provisions of this  
48 subsection shall be paid the rate predetermined for journeymen in that particular craft  
49 and/or classification.
- 50 j. Wages shall be paid without any deductions except authorized deductions. Employers not  
51 parties to a contract requiring contributions for employee benefits which the Secretary of  
52 Labor and Industry has determined to be included in the general prevailing minimum wage  
53 rate shall pay the monetary equivalent thereof directly to the workmen.
- 54 k. Payment of compensation to workmen for work performed on public work on a lump sum  
55 basis, or a piece work system, or a price certain for the completion of a certain amount of  
56 work, or the production of a certain result shall be deemed a violation of the Act and the

- related resolutions set forth in Title 34, Part I, Chapter 9, Subchapter E of the Pennsylvania Administrative Code regardless of the average hourly earnings resulting therefrom.
- l. The contract shall also provide that each Contractor and each subcontractor shall file a statement each week and a final statement at the conclusion of the work on the contract with the Owner, under oath, and in form satisfactory to the Secretary of Labor and Industry, certifying that all workmen have been paid wages in strict conformity with the provisions of the contract as prescribed by Title 34 of the Pennsylvania Administrative Code, Section 9.103, or if any wages remain unpaid to set forth the amount of wages due and owing to each workman respectively. Owner reserves the right to withhold payment to Contractor if it fails to submit these statements to Owner with the applicable Application for Payment.
- m. The provisions of the Act and Title 34, Part F, Chapter 9, Subchapter E of the Pennsylvania Administrative Code shall be incorporated by reference in the contract.

F. DISCRIMINATION PROHIBITED AND COMPLIANCE WITH ADA:

1. Contractor, at its own expense, shall conform to the nondiscrimination policies and plans required by the Contract Documents, the laws of the Commonwealth of Pennsylvania and all other laws applicable to the Project.
- a. In the hiring of employees for the performance of Work under this Agreement, neither the Contractor nor any person or entity acting on behalf of or under contract to the Contractor shall, by reason of gender, race, creed, religion, color, national origin or ancestry, disability, citizenship or any other status protected under the laws of the Commonwealth of Pennsylvania discriminate against any citizen who is qualified and available to perform Work which the employment relates.
- b. Neither Contractor nor any person or entity acting on behalf of or under Contractor shall discriminate, in any manner, against or intimidate any employee hired for the performance of Work on account of gender, race, creed, religion, color, national origin or ancestry, disability, citizenship (subject to prevailing law) or any other status protected under the laws of the Commonwealth of Pennsylvania.
- c. Unless exempted by law, Contractor shall include the requirements of this section in every subcontract or purchase order so that it will be binding upon each subcontractor or supplier of the Contractor.
- d. In the event the Contractor believes it necessary to modify its sequence of Work, the work environment or means and methods to comply with the applicable requirements of the Americans with Disabilities Act (ADA), Contractor shall notify the Construction Manager in writing of the proposed modification. The Construction Manager shall have a reasonable period of time to review the request and may seek advice and consent from the Owner and Architect before responding in writing to Contractor. All costs of the proposed modifications shall be borne by Contractor, including impact costs to other Contractors or other parts of the Project, including any claims arising therefrom. Contractor shall implement no modification until he receives written consent from the Construction Manager. Nothing herein shall be construed to make the Owner, Construction Manager or Contractor responsible for conformance of the Architect's design to ADA requirements.
- e. If Contractor, its employees, subcontractors, suppliers or any other person or entity responsible to Contractor fails to comply with any applicable law or requirement of this Agreement or the Contract Documents, upon written notice from the Construction Manager, Contractor shall commence to cure such non-compliance within twenty-four (24) hours and shall achieve compliance within seventy-two (72) hours of receipt of written notice. Any failure of Contractor to do so after written notice to comply shall constitute a breach of contract and the Owner, in addition to its other rights in the event of a breach, shall have the right to terminate Contractor's right to perform the Work.
- f. This Contract may be cancelled or terminated by the Bristol Township School District and all money due or to become due hereunder may be forfeited, for a violation of the terms or conditions of this portion of the contract.

1       G.     COMPLIANCE WITH STEEL PRODUCTS PROCUREMENT ACT:

- 2           1.     PROVISION FOR THE USE OF STEEL AND STEEL PRODUCTS MADE IN THE U.S. In  
3                 accordance with Act 3 of the 1978 General Assembly of the Commonwealth of Pennsylvania, as  
4                 amended, 73 P.S. Sections 1881-1887, if any steel or steel products are to be used or supplied in  
5                 the performance of the contract, only those steel products produced in the United States as defined  
6                 therein shall be used or supplied in the performance of the contract or any subcontracts thereunder.

7  
8                 In accordance with Act 161 of 1982, as amended, cast iron products shall also be included and  
9                 produced in the United States. Act 141 of 1984, as amended, further defines "steel products" to  
10                include machinery and equipment. The act also provides clarifications and penalties.

11  
12               Contractors and subcontractors shall also comply with 71 P.S. Section 773.110 dealing with  
13               aluminum or steel products made in a foreign country which has been determined to discriminate.

14  
15               In accordance with the Trade Practices Act of July 23, 1968, P.L. 686 (71 P.S. § 773.101 et seq.),  
16               the Contractor cannot and shall not use or permit to be used in the Work any aluminum or steel  
17               products made in a foreign country which is listed below as a foreign country which discriminates  
18               against aluminum or steel products manufactured in Pennsylvania. The countries of Argentina,  
19               Brazil, South Korea, and Spain have been found to discriminate against certain products  
20               manufactured in Pennsylvania. Therefore, the purchase or use of those countries' products, as  
21               listed below, is not permitted:

- 22  
23               a.     Argentina: carbon steel wire rod and cold-rolled carbon steel sheet.  
24               b.     Brazil: welded carbon steel pipes and tubes; carbon steel wire rod; tool steel; certain  
25               stainless steel products, including hot-rolled stainless steel bar; stainless steel wire rod and  
26               cold-formed stainless steel bar; prestressed concrete steel wire strand; hot-rolled carbon  
27               steel plate in coil; hot-rolled carbon steel sheet; and cold-rolled carbon steel sheet.  
28               c.     South Korea: welded carbon steel pipes and tubes; hot-rolled carbon steel plate; hot-rolled  
29               carbon steel sheet; and galvanized steel sheet.  
30               d.     Spain: certain stainless steel products, including stainless steel wire rod, hot rolled  
31               stainless steel bars; and cold-formed stainless steel bars; pre-stressed concrete steel wire  
32               strand; and certain steel products, including hot-rolled steel plate, cold-rolled carbon steel  
33               plate, carbon steel structural shapes; galvanized carbon steel sheet, hot-rolled carbon steel  
34               bars, and cold-formed carbon steel bars.

35  
36               Penalties for violation of the above paragraphs may be found in the Trade Practices Act,  
37               which penalties include becoming ineligible for public works contracts for a period of  
38               three years.

39  
40               This provision in no way relieves the Contractor of responsibility to comply with those  
41               provisions of the Contract which prohibit the use of foreign-made steel and cast iron  
42               products.

- 43       H.     RIGHT TO KNOW ACT: Contractor shall comply with all terms and conditions of the Pennsylvania  
44               Right to Know Law, 65 P.S. § 67.101, et seq., as amended and its implementing regulations.

- 45       I.     COMPETENT WORKMEN: As required by 24 P.S. Section 7-752, no person shall be employed to do  
46               work under this Contract except competent and first-class workmen, and mechanics, meaning those who  
47               are duly skilled in their respective branches of labor and who shall be paid not less than such rates of  
48               wages and for such hours' work as shall be the established and current rates of wages paid for such hours  
49               by employers of organized labor in doing similar work in the School District where the work is being  
50               done.  
51

1 J. PREVENTION OF ENVIRONMENTAL POLLUTION:

- 2 1. Section 3301 of the Pennsylvania Commonwealth Procurement Code requires that all invitations  
3 for Bids and requests for proposals for construction projects issued by any governmental agencies  
4 shall set forth any provision of Federal and State statutes, rules, and regulations dealing with  
5 prevention of environmental pollution and the preservation of public natural resources that affect  
6 the Project. In this regard, Bidder is directed to a Notice of said provisions prepared by the  
7 Pennsylvania Department of Environmental Resources under Act 247 of 1972, 52 P.S. § 1612  
8 (repealed). Contractor is hereby notified and agrees to comply with the terms of all statutes, rules  
9 and regulations enumerated in said Notice. Where any identified environmental statute, rule  
10 and/or regulation has been revised, amended, supplemented, repealed and/or supplanted,  
11 Contractor shall comply with such statute, rule and/or regulation as so modified. Notwithstanding  
12 the foregoing, failure to include any applicable environmental statute, rule and/or regulation in the  
13 Notice shall not relieve Contractor of its obligation to comply with same.

14 K. E-VERIFY:

- 15 1. The Contractor and its subcontractors (as such term is defined in the act) are required to comply  
16 with the Public Works Employment Verification Act, Act No. 127, July 5, 2012 (formerly Senate  
17 Bill 637) EVA and regulations issued thereunder, as the same may be amended from time to time.  
18 Within ten (10) days of receipt of a Notice of Intent to Award, and as a pre-condition of being  
19 awarded the Contract, the successful Bidder shall submit to the Owner the employment  
20 verification form required by the EVA acknowledging its responsibilities and its compliance with  
21 the EVA. Per the EVA, the employment verification form is to be obtained from the Secretary of  
22 the Pennsylvania Department of General Services. Per the EVA, the verification form shall  
23 include a certification that the information in the statement is true and correct and that the  
24 individual signing the statement understands that the submission of false or misleading  
25 information in connection with the verification shall subject the individual and the public works  
26 Contractor or subcontractor, as the case may be, to sanctions provided by law; and the verification  
27 form shall be signed by a representative of the public works Contractor or subcontractor, as  
28 applicable, who has sufficient knowledge and authority to make the representations and  
29 certifications contained in the statement. Per the EVA, Contractor's subcontractors (as defined in  
30 the EVA) shall provide, and Contractor shall cause its subcontractors to provide, their verification  
31 forms prior to commencing work on the project.

32 L. PROPOSAL MISTAKE CLAIMS:

- 33 1. Negligence by the Bidder in preparing his proposal confers no right of withdrawal or modification  
34 of his proposal after such proposal has been opened. No claims on account of mistakes or  
35 omissions of any proposal will be considered. Notwithstanding the above, a Bidder may withdraw  
36 his proposal within two (2) business days after the Bid opening time subject to and in accordance  
37 with the Public Contracts – Withdrawal of Bids Law, Act of January 23, 1974, P.L. 9, No. 4, 73  
38 P.S. § 1601 et seq., as amended. A Bid which has been opened may be withdrawn only in  
39 accordance with the causes set forth in said Act and for no other reasons. Strict compliance with  
40 said Act is required to withdraw a Bid after opening.

41 M. IRREGULAR PROPOSALS:

- 42 1. Proposals indicating a qualification of the Bid, conditions or uninvited alternate Bids or which  
43 contain alteration of the form request for a proposal, or additions or deductions not called for shall  
44 be rejected. Bids containing minor irregularities or informalities, not relating to price, time, or  
45 changes affecting the quality of work, may be rejected at Owner's sole discretion. Owner reserves  
46 the right to waive any such informalities or irregularities.  
47

1      N.      FAILURE TO EXECUTE CONTRACT:

- 2            1.      Failure of the Bidder to whom Notice of Intent to Award has been given to deliver appropriate  
3                      Payment and Performance Bonds, Certificates of Insurance, Employment Verification Form, or  
4                      execute the Agreement within the time specified, shall constitute a default by such Bidder and the  
5                      Owner may, at its sole discretion, award the contract to the next lowest responsive and responsible  
6                      Bidder or re-advertise for Bids, and the defaulting Bidder shall pay to the Owner the difference  
7                      between the amounts of his Bid and any higher amount for which the Owner may contract for the  
8                      required work, plus any advertising, consulting, legal or other expenses incurred by reason of the  
9                      default. The Bid Security of such defaulting Bidder shall be applied on account of said damages,  
10                     and if the amount of said damages exceeds the amount of the Bid Security, the defaulting Bidder  
11                     shall pay to the Owner the full amount of the excess.

12      O.      TAXES:

- 13            1.      Contractor shall be responsible for and shall pay all applicable sales, use, excise or other taxes  
14                      required by law on all materials, tools, apparatus, equipment, fixtures, services, incidentals or  
15                      otherwise which may be purchased or used in connection with the Work or portions thereof. The  
16                      Bid shall be made in accordance with such laws and shall include all applicable taxes in the Bid  
17                      amount.

18  
19                      Notwithstanding the foregoing, however, Owner is exempt (excluded) from sales and/or use tax in  
20                      Pennsylvania on certain transactions. Contractor and all subcontractors shall bid and shall  
21                      purchase as exempt (excluded) from Pennsylvania sales and/or use tax all tangible personal  
22                      property within the definition of 'building machinery and equipment' as that term is defined in Act  
23                      No. 45-1998 (72 P.S. § 7201 et seq.). A copy of this portion of such Act is obtainable from Owner  
24                      upon request. No charges shall be allowed for such exempt items. It shall be the Contractor's  
25                      responsibility to determine those items for which an exemption will apply, and the Contractor  
26                      shall obtain legal or other tax advice to determine how and to what extent an exemption from the  
27                      taxes apply. In order to facilitate such purchase free of sales and/or use tax in Pennsylvania, and  
28                      upon certification by Contractor that an item is, in fact, tax exempt, the Owner agrees to execute a  
29                      tax exemption certificate prepared by Contractor or a subcontractor as may be required by the  
30                      regulations of the Pennsylvania Department of Revenue.

31      END OF DOCUMENT 004440

## DOCUMENT 004445 – RACP COMPLIANCE REQUIREMENTS

**COMMONWEALTH OF PENNSYLVANIA – OFFICE OF BUDGET – BUREAU OF  
REVENUE, CAPITAL & DEBT****REDEVELOPMENT ASSISTANCE CAPITAL PROGRAM (RACP)**

The construction contractor (“Contractor”) and its subcontractors recognize that compliance with these requirements is mandated by the Commonwealth of Pennsylvania in the performance of this construction contract (“Contract”). These requirements will be included in the Berwyn Fire Company’s contract with the Contractor; and this document, Document 004440 – Compliance Requirements, will be included as an attachment to the Standard Form of Agreement Between Owner and Contractor.

## 1.1 COMPLIANCE REQUIREMENTS

A. Key Compliance Guidelines of the Commonwealth of Pennsylvania – Office of Budget – Bureau of Revenue, Capital & Debt | Redevelopment Assistance Capital Program (RACP) is hereby incorporated into the Procurement and Contracting Requirements by reference.

1. A copy of the Key Compliance Guidelines is bound in this Project Manual.
2. A copy of the Guidance on Steel Certification Relative to the Redevelopment Assistance Capital Program (RACP) is bound in this Project Manual.

I am aware of the Compliance Requirements of the Commonwealth of Pennsylvania – Office of Budget – Bureau of Revenue, Capital & Debt | Redevelopment Assistance Capital Program (RACP) identified above. I certify that to the best of my knowledge the Berwyn Fire Company project will meet all of these requirements.

**ATTEST:**\_\_\_\_\_  
Title\_\_\_\_\_  
Title\_\_\_\_\_  
Date\_\_\_\_\_  
Date

Sworn to and Subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_, 2023.

My Commission expires \_\_\_\_\_. NOTARY PUBLIC \_\_\_\_\_.

**THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED**

END OF DOCUMENT 004440

## KEY COMPLIANCE GUIDELINES

It is suggested that a copy of this complete document be given to your Project, Construction Manager, and/or Architect so that they are fully aware of the RACP requirements related to each. This document should be included in your bid packages, and should be made an addendum to any and all construction contracts, plans and specifications related to the RACP project.

Compliance with all RACP requirements, including the key items in these guidelines will be monitored frequently throughout the construction phase of your project and will be reviewed once more during the legislatively mandated close-out audit.

## COMPETITIVE BIDDING REQUIREMENTS

The sole and exclusive bidding requirement for RACP projects is in the Capital Facilities Debt Enabling Act (Act 67 of 2004), which states "Notwithstanding any other provision of law, the solicitation of a minimum of three written bids for all contracted construction work on redevelopment assistance capital projects shall be the sole requirement for the composition, solicitation, opening and award of bids on such projects." Unless the terms of the law change, the Office of the Budget cannot grant waivers for bidding requirements to Grantees.

RACP projects are not subject to separation of trades. You are REQUIRED to solicit a minimum of three (3) bids for "all generally contracted work" being performed within the RACP defined scope of work. You are not required to receive three (3) bid responses. However, you should provide documentation to prove that at least three bids were solicited by providing copies of the solicitation letters (preferably on letterhead of the bidding entity) used in the bidding process. You are not required to select the lowest bidder, but if you do not, you will have to provide a brief written justification for your selection. Note: there is NO threshold level under the RACP program regardless of the size or dollar amount associated with the work to be performed. You need to show that you solicited a minimum of three (3) bids for any contract to be eligible for RACP.

Bidding is acceptable at either the general contractor level (described in option a. below) or at the sub-contractor level (described in option b. below):

- **General Contractor (GC) Level** - If you chose to bid at the GC level, please note that the bid should encompass the entire RACP scope of work to be performed including all associated construction work. The dollar amount bid on the project must include 100% of the work to be performed by the GC and the sub-contractors. Bidding at the GC level will require submission of bidding and construction related documents at the GC level only (see Sub-Contractor level below for a distinction)
- **Sub-Contractor Level** - If you choose not to solicit three bids for a General Contractor, then you are required to solicit a minimum of three bids for EACH Sub-Contractor covering all trades involved in the project. Note that any self-performed work by a non-bid GC is NOT an eligible cost for reimbursement OR match purposes. Bidding at the Sub-Contractor level will require submission of bidding and construction related documents at the sub level...meaning proof of



bidding, construction contracts, payment and performance bonds, insurance etc. will need to be provided for every sub-contractor in the RACP scope.

Professional Services: Professional services associated with the project are not required to be bid as these associated costs are only eligible as match.

Change Orders: Grantees and/or Sub-Grantees are not required to competitively bid out change orders as long as the work was within the RACP scope of the original bid and is less than 20% of the total contract. If a change order is for work beyond the RACP scope of work originally bid, the Grantee will be required to competitively bid out the new scope of work in order to be considered RACP eligible.

## **PENNSYLVANIA STEEL PRODUCTS PROCUREMENT ACT**

The Office of the Budget (OB) cannot grant waivers to the Pennsylvania Steel Products Procurement Act (SPPA) unless the terms of the law change. All RACP Grantees must comply with the SPPA. If a Grantee/RACP project fails to abide by the SPPA, it does so at its own risk.

[A full explanation on the RACP steel requirements is available as a PDF download.](#)

Up to 2011, OB only accepted the ST-4 Form (justification for the use of foreign steel) that the Department of General Services (DGS) had exclusively devised to address exceptions linked to the requirements of the SPPA, when it was necessary. Since 2011, OB has approved the acceptability of two more DGS ST Forms (ST-2, ST-3) with some caveats, providing that the forms are properly filled out. The ST-1 Form will not be accepted by OB. It is not necessary for the ST-2, ST-3, and ST-4 Forms to be notarized.

Effective January 1, 2013, OB began utilizing the DGS Exempt Machinery and Equipment Steel Products listings ([2022](#), [2021](#), [2020](#)) as part of our steel policy. DGS published a Statement of Policy- Steel products procurement in the Pennsylvania Bulletin Volume 43, Number 6 dated February 9, 2013 (See PA Bulletin #43, pages 85-86) that discussed the exemption of certain steel products, based on their analysis of ST-4 forms submitted that list products not produced domestically in sufficient quantity. DGS publishes an updated "Exemption List" annually.

Please be aware that ST forms are acceptable only in cases where nonstructural steel needs to be addressed. The DGS ST forms do not replace the steel certification forms associated with structural steel. OB will continue to require the submission of steel mill certifications to demonstrate compliance with the steel requirements for structural steel.

The PDF copies of the three acceptable ST Forms for RACP listed below can be obtained from the RACP website:

- [ST-2 Steel Origin Certification: Non-Identifiable, Non-Structural Steel](#)
- [ST-3 75% U.S. Manufacture Certification](#)
- [ST-4 Not Domestically Manufactured: Prime Contractor](#) (only to be used when requesting items to be exempted that are not found on the current year's List of Exempt Machinery and Equipment Steel Products)

It is suggested that the certifications be collected at the time any steel for the project is purchased and delivered to ease the collection process.

Be advised that OB DOES NOT need to approve the ST forms prior to the start of the construction period. The ST forms need to be submitted to demonstrate that compliance, when and where necessary, has been met.

We shall deem as ineligible all contracts that are unable to demonstrate compliance via the submission of steel certifications for Structural Steel and for Non-structural Steel the submission of steel certifications and/or ST forms and/or DGS Exempt Machinery and Equipment Steel Products List. Therefore, the value of construction contracts associated with non-compliant steel will be removed (both materials and labor costs) from the scope of the project, which may in turn affect the project's ability to leverage their full grant amount (project may not receive its full grant).

Recycled products, melted from previously used steel, are acceptable, providing that adequate documentation from the supplier has been furnished. The supplier shall certify that the recycled steel product was produced in the USA.

## TRADE PRACTICES ACT

In accordance with the Trade Practices Act of July 23, 1968, P.L. 686 (71 P.S. § 773.101 et seq.), the Grantee cannot and shall not use or permit to be used in the work any aluminum or steel products made in a foreign country which is listed below as a foreign country which discriminates against aluminum or steel products manufactured in Pennsylvania. The countries of Argentina, Brazil, South Korea, and Spain have been found to discriminate against certain products manufactured in Pennsylvania. Therefore, the purchase or use of those countries' products, as listed below, is not permitted:

- **Argentina:** carbon steel wire rod and cold-rolled carbon steel sheet.
- **Brazil:** welded carbon steel pipes and tubes; carbon steel wire rod; tool steel; certain stainless steel products, including hot-rolled stainless steel bar; stainless steel wire rod and cold-formed stainless steel bar; pre-stressed concrete steel wire strand; hot-rolled carbon steel plate in coil; hot-rolled carbon steel sheet; and cold-rolled carbon steel sheet.
- **South Korea:** welded carbon steel pipes and tubes; hot-rolled carbon steel plate; hot-rolled carbon steel sheet; and galvanized steel sheet.
- **Spain:** certain stainless steel products, including stainless steel wire rod, hot-rolled stainless steel bars; and cold-formed stainless steel bars; pre-stressed concrete steel wire strand; and certain steel products, including hot-rolled steel plate, cold-rolled carbon steel plate, carbon steel structural shapes; galvanized carbon steel sheet, hot-rolled carbon steel bars, and cold-formed carbon steel bars.

Penalties for violation of the above paragraphs may be found in the Trade Practices Act, which penalties include becoming ineligible for public works contracts for a period of three years.

This provision in no way relieves the Grantee of responsibility to comply with those provisions which prohibit the use of foreign-made steel and cast iron products.

## **PUBLIC WORKS CONTRACTORS' BOND LAW (PAYMENT & PERFORMANCE BONDS)**

The requirement for 100% payment and performance (P&P) bonds is a state law; the Office of the Budget cannot waive this requirement.

A performance bond must be obtained at 100% of the contract amount, conditioned upon the faithful performance of the contract in accordance with the plans, specifications, and conditions of the contract. Such bond shall be solely for the protection of the contracting body which awarded said contract.

A payment bond must be obtained at 100% of the contract amount. Such bond shall be solely for the protection of claimants supplying labor or materials to the Grantee, its contractor or to any of its subcontractors, in the prosecution of the work provided for in such contract, and shall be conditioned for the prompt payment of all such material furnished or labor supplied or performed in the prosecution of the work. "Labor or materials" shall include public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the site.

## **PA PREVAILING WAGE ACT (PWA)**

The Office of the Budget cannot grant waivers for the PA Prevailing Wage Act. All Grantees must comply with the act. Grantees that fail to abide by the Prevailing Wage Act do so at their own risk. Please do not assume that PA Prevailing Wage is always consistent with your local union wages.

All projects should apply for a wage determination letter prior to the start of construction by registering the project with the PA Department of Labor and Industry to obtain the prevailing wage rates relevant to your project. This determination sheet will provide the necessary trade classifications for the project, along with their corresponding hourly wage and hourly fringe rates that are required for the certified payrolls required as part of RACP. The wage determination should be obtained within 120 days of the award of construction contracts. If necessary, the Department of Labor and Industry can issue determinations letters after construction has begun.

The prevailing wage information and forms can be found on the [PA Department of Labor & Industry website](#).

## **AMERICANS WITH DISABILITIES ACT (ADA)**

Typically your architect should provide a letter stating the plans and specs are in compliance with ADA regulations. Additionally, the Grantee agrees to comply with the General Prohibitions Against Discrimination, 28 C.F.R. § 35.130, and all other regulations promulgated under Title II of The Americans with Disabilities Act which are applicable to all benefits, services, programs, and activities provided by the commonwealth through contracts.

## **FIDELITY BONDS**

The Grantee shall procure and furnish evidence to OB of fidelity bonds with coverage to be maintained under the administrative title of the position in amounts and for such positions as are reasonably

determined by OB. Fidelity Bonding is also commonly known as "Employee Dishonesty Insurance." The minimum level of coverage should equal the average monthly RACP reimbursement amount based on the total grant amount.

## **INSURANCE REQUIREMENTS**

- Worker's Compensation Insurance - The Grantee shall provide Worker's Compensation Insurance where required, and shall accept full responsibility for the payment of premiums for Worker's Compensation Insurance and Social Security, as well as income tax withholding and any other taxes or payroll deductions required by law for its employees who are performing services related to the project.
- General Liability & Property Damage Insurance - The Grantee will provide and maintain comprehensive general liability and property damage insurance in the minimum amount of \$250,000.00 per person for injury and death in a single occurrence; \$1,000,000.00 per occurrence for injury or death of more than one (1) person in a single occurrence; and \$500,000.00 for a single occurrence of property damage, and which shall be endorsed to protect the commonwealth.
- Flood Insurance – If the project is wholly or partially within a floodplain, proof of sufficient flood insurance coverage must be provided. In any case, a project is required to provide a copy of a floodplain map of the project area, with the project site being delineated thereon.

*Identify Commonwealth as Additional Insured:* The commonwealth shall be listed on the above insurance policies as an additional insured. Upon request, the Grantee shall furnish proof of insurance as required by this section to OB.

## **RESTRICTIONS ON GOVERNMENTAL ENTITIES SELLING RACP PROJECTS**

Article 8 of the RACP Grant Agreement spells out sale price restrictions for a governmental entity that sells property that was acquired and/or improved with RACP funds. The restrictions are required to insure that the Grantees CANNOT sell the property for a net gain or even recoup the value of the grant in the sale price. [A PDF download is available that contains more information on Article 8.](#)

## FREQUENTLY ASKED QUESTIONS

The following questions have often been asked by RACP Grantees, Sub-Grantees and Commonwealth consultants on RACP projects.

### **ELIGIBILITY**

1. **WHAT TYPE OF PROJECT/GRANTEE IS RACP-ELIGIBLE?** A project is eligible for a RACP grant if it has a cultural, civic, historical, regional or multi-jurisdictional impact and generates substantial increases in employment, tax revenues or other measures of economic activity. Grantees must be either (1) a general-purpose form of local government unit (city, borough, township or county), (2) any public authority, (3) a federally designated Local Development District or (4) an industrial development agency, which has been certified as such by the Pennsylvania Industrial Development Authority (PIDA) board and which is itself or is acting through a wholly owned subsidiary exempt from federal taxation under section 501 (c) (3) of the Internal Revenue Code of 1986. The Grantee must follow strict guidelines to avoid jeopardizing the tax-exempt status of the bond funding.
  
2. **WHAT TYPE OF PROJECT IS NOT RACP-ELIGIBLE?** Projects that are state-funded; facilities or projects that can normally obtain primary funding under other state programs; projects whose main purpose is for highways (including road and street improvements) and vehicular bridges, drinking water and wastewater facilities, housing units and waste disposal facilities are not eligible for RACP grants. If an RACP project does include and require improvements to housing, roads, bridges, tunnels, infrastructure, and/or drinking water/waste disposal/wastewater/stormwater systems, these improvements must not be the primary focus of the project. Per Act 77 of 2013, they must be associated with a project that is part of an economic development project; and in the case of housing, must be part of a community revitalization plan. These additional requirements for housing projects are not required if the funding is from a designated special allocation for housing. Projects located in a City Revitalization and Improvement Zone (CRIZ), and eligible for CRIZ benefits, are not eligible RACP projects. However, approved RACP grants that existed prior to zone approval shall not be restricted.
  
3. **IS A SCHOOL DISTRICT AN ELIGIBLE GRANTEE?** A school district, which is a "special purpose of local government," would not be eligible because RACP Grantees must be authorities or "general-purpose forms of local government." (See the answer to Question 1 above.) However, a school district can be the Sub-Grantee of an eligible Grantee.

4. **IS THERE A MINIMUM THRESHOLD FOR A RACP PROJECT?** The statutes governing the RACP program require a minimum threshold of \$1 million for each project before it can be funded.
5. **DURING THE APPLICATION PROCESS, THE AGENCY THAT RECEIVED THE AUTHORIZATION FOR THE PROJECT WAS DISSOLVED AND ANOTHER ORGANIZATION PICKED UP THE PROJECT. MAY THE NEW ORGANIZATION USE THE RACP FUNDS TO COMPLETE THE PROJECT?** It depends on the circumstances of the dissolution. The Office of the Budget will treat such situations on a case by case basis. For instance, if the dissolution resulted in an acquisition or a merger, the project can be pursued.
6. **WHAT IS THE IMPORTANCE OF THE CAPITAL BUDGET PROJECT ITEMIZATION BILL TO MY PROJECT?** All grants awarded through RACP MUST be for projects included in one or more of the Capital Budget Project Itemization Acts passed by the General Assembly and signed into law by the Governor. You will need to 1) identify the appropriate Act(s) for which your project has been itemized and 2) verify that sufficient funding remains from said itemization in order to submit an e-RACP Application to RACP for consideration and evaluation of your project. Only itemizations/projects from these Acts that have remaining "Project Allocation" amounts and that have not been statutorily "sunset" in accordance with Act 77 are eligible. No project expense paid prior to the project's Capital Budget Itemization Act's effective date is usable as a reimbursable and/or match item for the RACP project (excluding land match).

## **ACT AND COMMITMENT**

7. **GIVEN THE DIRECTIVE REGARDING THE FILING OF THE FORMAL APPLICATION AND BUSINESS PLAN WITHIN SIX MONTHS OF THE AWARD LETTER, WILL THE FUNDING BE TERMINATED FROM A PROJECT EVEN IF AN EXTENSION REQUEST HAS BEEN SUBMITTED BEFORE THE DEADLINE?** The Office of the Budget must receive the formal Application and Business Plan within six months of the date of the Award Letter. If the Grantee fails to submit the formal Application and Business Plan within the allotted time frame, funding for the project may be terminated.

## **GRANT AGREEMENT AND DRAWDOWN**

8. **WE HAVE RECEIVED AN AWARD LETTER FOR THE RELEASE OF FUNDING FOR OUR RACP PROJECT. WHAT DO WE NEED TO DO TO OBTAIN THE FULL GRANT AMOUNT?** After the release of funding for a RACP project is approved, the Office of the Budget issues an Award Letter to serve as written notification authorizing the preparation and submission to the Office of the Budget of a formal Application and Business Plan for the project. Grant Recipients are required to notify the Office of the Budget within 30 days of receipt of an Award Letter as to whether or not they are accepting the grant. The formal Application and Business Plan contains

sections that must be addressed, including the match amount, project plans and specifications, budget and detailed sources of funding. An Application and Business Plan Handbook can be downloaded from the RACP website and contains the necessary forms and instructions for the preparation of the formal Application and Business Plan. The Application and Business Plan must be submitted in electronic format (PDF) via upload to an RACP FTP site. The eligible Applicant/Grantee designated for the project will be emailed a unique Username and Password to access this FTP site within approximately 3 weeks of receiving the Award Letter.

**9. I HAVE SUBMITTED MY FORMAL APPLICATION AND BUSINESS PLAN. WHAT HAPPENS NEXT?**

Once the Office of the Budget receives a formal Application and Business Plan, the Office of the Budget conducts a preliminary review and hires a consultant to conduct an exhaustive review of the Application and Business Plan. A consultant will contact you to set up the Application and Business Plan review. After the consultant completes the review, he or she sends a report to the Office of the Budget. The Office of the Budget is then able to draft the agreement between the Commonwealth and the Grantee.

**10. HOW IS MY GRANT AGREEMENT VALIDATED AND EXECUTED?** The draft grant agreement, including any applicable special conditions, is sent to the Grantee for signature. Once it is signed and returned to the Office of the Budget, it is circulated within the Commonwealth for validation and execution, a procedure that typically lasts from eight to ten weeks. The signatories are the Secretary of the Budget; the Office of the Budget's Chief Counsel; the Deputy General Counsel; the Deputy Attorney General; and the Bureau of Payable Services.

**11. WHAT IS THE AVERAGE TIME TO HAVE THE GRANT AGREEMENT EXECUTED?** In most cases, after receiving the signed grant agreement from the Grantee, it can be executed within ten (10) to twelve (12) weeks of receipt of the Application and Business Plan review report.

**12. WHAT ARE "SPECIAL CONDITIONS"?** Special conditions are additional documentation that Grantees must submit in order to receive any grant funding. The special conditions are located in Appendix B to the grant agreement.

**13. HOW DO I SATISFY MY SPECIAL CONDITIONS?** After the grant agreement is fully executed, a six (6) month time period is set to submit documentation to satisfy the special conditions. Grantees must submit the original special conditions documentation to the Office of the Budget and send a copy to the state consultant assigned to their project. Transmittal letters should be included with all submissions of documents to the Office of the Budget and the consultant. All transmittals should reference the contract number found on the first page of the executed Grant Agreement.

- 14. CAN I SUBMIT MY SPECIAL CONDITIONS PACKET ELECTRONICALLY?** All submissions of Special Conditions Documents must be done via upload to RACP's specified FTP site. The eligible Applicant/Grantee designated for the project should have been emailed a unique Username and Password to access the RACP FTP site after receiving their award letter, per FAQ #8 above. Special Conditions are outstanding documentation that is required to be submitted prior to an entity being eligible to receive grant funds. They are found in Appendix B of a typical RACP Grant Agreement. Please refer to section I (B) of the Application and Business Plan Handbook for information on how to access the RACP FTP site. Note: Please upload the documents to the "Special Conditions" sub-folder at this stage of the grant process.
- 15. MY SIX-MONTH TIME PERIOD FOR SUBMITTING DOCUMENTATION TO SATISFY THE SPECIAL CONDITIONS IS NEARING, CAN I OBTAIN AN EXTENSION?** You can submit an extension request to the Office of the Budget stating the need for the extension, the reason(s) why the original deadline could not be met and your current project status. The Office of the Budget will review your request and, if significant progress has been made, may grant an extension. You will receive written notification if such an extension is granted.
- 16. ONE OF MY SPECIAL CONDITIONS REQUIRES A COOPERATION AGREEMENT TO BE SUBMITTED FOR REVIEW AND SUBSEQUENT APPROVAL. IS THERE A COOPERATION AGREEMENT TEMPLATE AVAILABLE?** Due to the unique relationship associated with the parties executing a Cooperation Agreement, the Office of the Budget (OB) is unable to provide a template that would accommodate the uniqueness of each RACP project. Please note that the following four elements should typically be included in the Cooperation Agreement: 1) RACP project name; 2) ME 300-xxxx; 3) RACP grant award amount; and 4) an indication that the Sub-Grantee(s) will comply with the terms and conditions of the RACP Grant Agreement and Redevelopment Assistance program. Please further note that dependent on your project's situation, OB may request additional elements be added.
- 17. HOW DOES THE RACP REIMBURSEMENT PROCESS WORK?** Once all special conditions to the Grant Agreement have been satisfied and compliance met, Commonwealth grant funds will become available for reimbursement. The RACP grant program operates on a proportional reimbursement basis. As the Grantee incurs and pays construction expenses, the Commonwealth will reimburse – contingent upon the corresponding expenditure of matching funds. Sufficient documentation regarding reimbursable expenditures and matching expenditures should be provided with any request for reimbursement.
- 18. WHEN MAY I START MY DRAWDOWN?** Grantees may start submitting their Payment Requests for reimbursement as soon as they have started construction and paid eligible costs.



Reimbursements are subject to compliance with the RACP Grant Agreement and the satisfaction of all the special conditions listed in Appendix B to the contract. The monthly drawdown amount is subject to the limitations shown in Appendix C to the Grant Agreement.

- 19. WILL I RECEIVE RACP GRANT FUNDS UP FRONT JUST BY ASKING FOR THEM?** During construction activities, the project is monitored for compliance by the consultant assigned to the project during the Application and Business Plan process. The Office of the Budget is required to reimburse the RACP grant on a proportional basis based on the corresponding expenditure of matching funds. It is important to know that the entire scope of the project must: (1) be in compliance with all RACP requirements listed in the Grant Agreement, such as those governing bidding, adherence to the Prevailing Wage Act and use of domestic steel and (2) satisfy all of the special conditions identified in the agreement between the Office of the Budget and the grant recipient before access to the RACP funding is granted. After the project reaches 100% completion, a portion of the grant may be retained pending satisfactory compliance of all RACP program requirements.
- 20. OUR COMMISSIONERS HAVE A SALES AGREEMENT IN PLACE WITH A DEVELOPER AND WOULD LIKE TO PURCHASE A PARCEL OF LAND. MAY WE USE THE RACP GRANT TO BUY THE PROPERTY WHILE WE DECIDE WHAT TO BUILD ON IT?** The statutes governing the RACP grant program permit the use of RACP proceeds for land acquisition; however, this cannot be the entire scope of the RACP grant. Some of the grant funding must be used for construction activities. The Office of the Budget cannot reimburse on land only, without any construction work.
- 21. WHERE MAY I DOWNLOAD THE PAYMENT REQUEST FORMS?** All reimbursement materials can be downloaded from [RACP Handbook & Forms](#) section on the RACP section of the Office of the Budget Web site.
- 22. WHEN SUBMITTING A REIMBURSEMENT REQUEST, WHAT SUPPORTING DOCUMENTATION IS REQUIRED FOR MATCH ONLY COST CATEGORIES?** Although supporting documentation (i.e. invoices and proof of payments) is not initially required for match only cost categories at the time of reimbursement request submission, please be prepared to submit additional information and/or documentation if it is requested by Office of Budget. Please remember that the Office of the Budget has sole discretion in determining the sufficiency and acceptability of the submitted documentation. The Office of the Budget also reserves the right to request additional information and/or documentation on match only costs after review of an initial pay request submission up to and including during performance of the legislatively mandated close-out audit.

- 23. IS ANYONE FROM THE OFFICE OF THE BUDGET AVAILABLE TO MEET WITH ME TO GO OVER THE RACP PROCESS AND EXPLAIN HOW TO PREPARE THE PAYMENT REQUEST FORMS?** Yes, the Grantee/Sub-Grantee (or their designated representatives) may request, at no cost to them, a facilitation meeting with an Office of the Budget employee involved in the RACP program. It is strongly suggested that meetings be held at the beginning of construction to go over the process and the preparation of the Payment Request forms. Requests for meetings should be made to the Office of the Budget Facilitation Manager at 717-214-5819. Past experience has shown that these meetings are very beneficial to the successful culmination of the grant process.
- 24. I HAVE JUST RECEIVED MY GRANT AGREEMENT WITH THE SPECIAL CONDITIONS LISTED. I HAVE ALREADY INCURRED CONSTRUCTION COSTS FOR REIMBURSEMENT. MAY I SUBMIT A PAYMENT REQUEST BEFORE MY SPECIAL CONDITIONS ARE SATISFIED?** You may submit your Payment Request forms while you are still submitting documentation and waiting for special conditions to be approved by the Office of the Budget. We can begin to process both items simultaneously. Please keep in mind, however, that no grant payment can be released until the special conditions have been satisfied, the compliance requirements have been met, and the Payment Request has been reviewed and accepted by the Office of the Budget.
- 25. MY SPECIAL CONDITIONS HAVE BEEN SATISFIED, AND I SUBMITTED MY FIRST PAYMENT REQUEST. NOW WHAT HAPPENS?** When reviewing a Payment Request, Office of the Budget looks at the Payment Request forms (PR1, PR1A, and PR1B's), the verifying documentation for appropriate categories, and the latest construction monitoring report from the Commonwealth assigned consultant, and documentation for special conditions (if it is the first Payment Request). No funds can be released until all special conditions are satisfied and the project is in compliance. Once the review process is completed by the Office of the Budget, the Payment Request is then sent to the Comptroller's Office, who then sends it to the Treasury Department. For this reason, adequate interim financing should be in place to bridge the gap between the time a Payment Request is submitted and the time a payment is actually disbursed. Please see the compliance section below for more information on interim financing.
- 26. MAY I RECEIVE MY GRANT DISBURSEMENT DIRECTLY INTO MY CHECKING ACCOUNT?** Yes, all grant disbursements are now being made to Grantees through the Commonwealth's Automated Clearing House (ACH) Network, which are commonly known as direct deposits. All Grantees must submit or must have already established its ACH information in the Commonwealth's Master Database. The [Commonwealth vendor registration](#) is an online process and Grantees/grant recipients should register as a [Non-Procurement Vendor](#). All Grantees will also be able to enroll to receive remittance information via electronic addenda and emails (e-Remittance). Enrollment information is available [here](#). Additional information and instructions can be found at [www.budget.pa.gov/services/forvendors](http://www.budget.pa.gov/services/forvendors). Questions regarding this process can be emailed directly to [RA-PSC\\_Supplier\\_Requests@pa.gov](mailto:RA-PSC_Supplier_Requests@pa.gov) or [rapscpaymentinquire@pa.gov](mailto:rapscpaymentinquire@pa.gov). Note: It is the responsibility of the Grantee to ensure that the ACH information contained in the Commonwealth's Master Database is accurate and complete.

Failure to maintain accurate and complete information may result in delays in grant disbursements.

- 27. DOES THE OFFICE OF THE BUDGET HOLD A CERTAIN PERCENTAGE OF THE PAYMENT? IF SO, HOW MUCH DOES IT HOLD?** Our retainage procedure differs from the typical procedure in the construction industry. The Office of the Budget reserves the right to retain up to 10% of the total grant amount. The retainage is calculated and applied after the Grantee submits the final Payment Request for reimbursement. The retained amount will be withheld from any amount due in the final Payment Request(s). The Grantees will be contacted, and the retainage will be released after the close-out audit has been successfully completed.

## **COMPLIANCE**

- 28. IS COMPLIANCE WITH THE GRANT AGREEMENT MONITORED DURING THE PROJECT'S CONSTRUCTION?** One of the Commonwealth's consultants will contact you to go over the construction monitoring phase review procedures. Usually, some type of monitoring begins when the Application and Business Plan review report is submitted. Periodic construction monitoring reports will be prepared by the consultant and submitted to the Office of the Budget and to the Grantee/Sub-Grantee once construction has begun. These reports are the basis for the Payment Request review procedures performed to determine ongoing compliance before Commonwealth funds are released. The project must be in full compliance to receive and continue to receive any RACP funds.
- 29. MY CONSTRUCTION PLANS HAVE CHANGED SINCE I SUBMITTED MY FORMAL APPLICATION AND BUSINESS PLAN. WHAT DO I NEED TO DO?** It is not necessary to forward the plans and specifications to us. The Office of the Budget will have a consultant review your project on site. Updates to the Application and Business Plan may be submitted and reviewed at any time. The Application and Business Plan that you submit is recognized as a "point-in-time" document that may need to be revised as you move through the design, bidding and construction phases.
- 30. WHAT CAN BE USED AS MATCH COSTS?** Typically, match costs include administration, legal, financing/accounting, architectural/engineering, land, furniture, fixtures, equipment and relocation costs that are directly related to the RACP project. Expenses paid before the authorization date are not eligible RACP costs (use of land as match ONLY is permissible.)

- 31. MAY WE USE OUR MORTGAGE AS A MATCH FUNDING SOURCE?** Generally, the Office of the Budget allows mortgages to be used as match funding as long as adequate supporting documents are available. The adequacy of any document is at the discretion of the Office of the Budget. We would be looking for terms of at least 20 years on any financing instruments.
- 32. WHAT ARE THE REQUIREMENTS FOR HAVING THE MATCH FUNDING SECURED?** One-half (50%) of the match funding must be secured at the time of the formal Application and Business Plan submission and before the grant agreement is drafted. After the grant agreement has been drafted, the Applicant/Grantee must document that 100% of the match funding is readily available before the Office of the Budget will start the reimbursement process. Signed pledges that are not yet received may count as the secured match only before the grant agreement is drafted. After that, evidence of the availability of the match (a cash receipt) must be demonstrated. As discussed below in Question 32, loans intended for match funding must be in the form of a long-term financing instrument.
- 33. WHY MUST LOANS INTENDED FOR MATCH FUNDING BE IN THE FORM OF A LONG-TERM FINANCING INSTRUMENT?** The Capital Facilities Debt Enabling Act requires that RACP projects be funded from proceeds of Commonwealth of Pennsylvania General Obligation (GO) bonds. GO bonds issued to finance the RACP grant program have a publicized maturity term of 20 years. Consequently, when a RACP Grantee uses loans as match funding, they must have a maturity cycle that demonstrates the long-term viability of the project. Past experiences have shown that RACP projects that use loans as match funds are in a better position to withstand economic downturns when those loans are in the form of a long-term financing instrument.
- 34. MAY WE USE A SIX-MONTH LINE OF CREDIT AS A MATCH FUNDING SOURCE?** A six-month line of credit is not viewed as long-term financing; therefore, it would be ineligible for RACP matching purposes. As discussed in Question 32 above, loans used as match funding should be in the form of a long-term financing instrument.
- 35. WE HAVE A SHORTFALL. MAY I USE MY LINE OF CREDIT AS A SECURED FINANCING INSTRUMENT FOR THE MATCH PORTION OF THE PROJECT?** Asking the Office of the Budget to recognize lines of credit or a business line as secured financing for the shortfall on a project is not satisfactory. The Office of the Budget accepts lines of credit as sources of interim financing but not as secured match funding. Please refer to Question 32.
- 36. WHAT IS THE PURPOSE OF INTERIM FINANCING?** All RACP projects are required to have permanent match funding in place for the match costs associated with that particular project. RACP is a reimbursement-based program. Consequently, a project will need to have interim financing in place to pay for monthly construction expenses before it can receive the RACP

grant. Interim financing is also needed to bridge the gap between the time a Payment Request is submitted and the time a payment is disbursed. Please refer to the Grant Agreement and Drawdown section above for more information on the payment processing time.

**37. MAY THE ENTIRE MATCH BE LAND?** The appraised value of land and buildings may typically serve as part of the match. The Office of the Budget would need to know the full cost of the project before saying land may be the sole match. Acceptance of land as the entire match would be at the sole discretion of the Office of the Budget. Any time that land is used in part or in total for the match, the grant recipient should own the property that is being listed as the match and would need to supply a copy of the title or deed. No lien is placed on the deed by the Office of the Budget.

**38. MAY FEDERAL OR MUNICIPAL FUNDS BE USED AS THE MATCH FUNDING SOURCE?** Yes, federal and local funds that are specifically earmarked for the project may serve as the match. Certain federal tax credits may also be used as the match. The statutes governing the RACP grant program do not allow the leveraging of other state funds within the confines of the RACP-defined project. Therefore, all other state funds must be removed from the project scope.

**39. OUR AWARD IS FOR \$2 MILLION, BUT OUR SPECIAL CONDITIONS STATE THAT WE NEED TO DOCUMENT SECURED MATCH FUNDING OF \$4 MILLION. WHY DO WE NEED TO DOCUMENT A MATCH FOR MORE THAN THE \$2 MILLION GRANT AMOUNT IF THE TOTAL PROJECT AMOUNTS TO \$6 MILLION?** You are required to document any and all of the match funding necessary to complete the project. Your total project cost is \$6 million and the grant is \$2 million; therefore, you would need to document a match of \$4 million, which is the balance of the project cost. The Office of the Budget wants to make sure that you have enough non-state funding to complete the project. In essence, the total project cost minus the RACP grant amount is the amount you need to document for the match.

**40. WE DO NOT HAVE ANY MATCHING FUNDS. CAN YOU WAIVE THIS REQUIREMENT TO FACILITATE THE RECEIPT OF THE STATE GRANT?** The requirement for matching funds cannot be waived. The RACP program requires that one-half (50%) of the match funding be secured at the time of formal Application and Business Plan submission and before the grant agreement is drafted. Therefore, without matching funds, there is no RACP grant. The RACP grant operates on a proportional reimbursement basis. As the Grantee incurs and pays construction expenses, the Commonwealth will reimburse – contingent upon the corresponding expenditure of match funding.

**41. THERE IS THE POSSIBILITY OF IN-KIND SERVICES FOR OUR PROJECT. FOR EXAMPLE, ONE OF THE CONTRACTORS AGREED TO DO SOME WORK AT NO CHARGE. MAY WE COUNT THE FAIR**

**VALUE OF IN-KIND GIFTS TOWARD OUR MATCH?** While it would clearly be beneficial to a RACP project to have such a donated gift, it cannot count toward the match, since all work must comply with the stated conditions, such as being contracted for and bid out and paying the prevailing wage.

**42. I NEED TO LET OUT MY BIDS. WHAT ARE THE BIDDING REQUIREMENTS?** The sole and exclusive bidding requirement for RACP projects is in the Capital Facilities Debt Enabling Act (Act 1 of 1999, as amended), which states, "Notwithstanding any other provision of law, the solicitation of a minimum of three written bids for all contracted construction work on redevelopment assistance capital projects shall be the sole requirement for the composition, solicitation, opening and award of bids on such projects. Notwithstanding the foregoing, the construction work shall be performed subject to the act of March 3, 1978 (P. L. 6, No. 3), known as the Steel Products Procurement Act." This means that all prime contractors, general contractors and subcontractors must be bid. Please note that solicitation is meant to indicate the act of actively asking, seeking, or pursuing firms to complete construction-related services based on the RACP-defined project scope. The law mandates that three written solicitations must be pursued; therefore, phone solicitations will not meet RACP bid requirements. Please be advised that self-bidding election must be approved by our Legal Department prior to bidding the RACP-delineated project scope. Please be advised that the bidding requirements would be satisfied if the RACP-defined project is publicly bid. The bidding format is at the discretion of the project representatives and subject to local requirements on trades composition.

**43. CAN THE BIDDING REQUIREMENT BE WAIVED?** Unless the terms of the law change, the Office of the Budget cannot grant waivers for bidding requirements to Grantees.

**44. DO I NEED TO BID FOR EACH SEPARATE TRADE IF MY GENERAL CONTRACTOR WAS BID FOR THE WHOLE CONTRACT AMOUNT?** RACP projects are not subject to separation of trades. You simply need to solicit three bids for "all generally contracted work," and you do not even need to take the lowest bid. However, you must provide the Office of the Budget with an explanation as to why the lowest bidder was not selected.

**45. DOES MY CONSTRUCTION MANAGER POSITION HAVE TO BE BID?** Construction manager services do not have to be bid. However, if the construction manager is not bid and serves mostly as a project manager/administrator, his or her costs could count only as match. The Office of the Budget will not reimburse any of the construction manager costs if they self-perform any of the construction work, since that work was not bid. Additionally, in order to protect the project/owner, performance and payment bonds must cover 100% of the total value of the construction.

**46. MAY RACP FUNDS BE USED TO COMPLETE A DESIGN/BUILD PROJECT?** You may proceed with a design/build approach and select whomever you want. However, in order to meet the RACP bidding requirement, the Office of the Budget will examine the bidding of the various subcontractors. To the extent the winning design/build contractor self-performs some of the construction work, you will need to demonstrate that you solicited three bids for the design/build approach. In addition, design costs are not reimbursable. Only the following costs are reimbursable: Construction, interest during construction, land (subject to certain restrictions) and permits.

**47. I INTEND TO SOLICIT BIDS VIA ELECTRONIC MEANS. WHAT DOCUMENTATION DO I NEED TO PROVIDE TO SUPPORT BID COMPLIANCE WITH RACP REQUIREMENTS IF THE BID SOLICITATION METHOD WAS PERFORMED VIA ELECTRONIC MEANS?** Please, be advised that the use of an electronic bidding software packages or free/paid website to solicit bids does not preclude/waive the requirement that documentation to support compliance with RACP bidding requirements be submitted for review (please refer to Question/Answer #13 and #19 above for further information). Please also note that if an electronic bidding software package or free/paid website is utilized to conduct the bid solicitation, a signed and notarized explanation on letterhead of the entity that conducted the bid solicitation will need to be submitted. The letter should include details, such as the name of the bidding software package or free/paid website used, how it works, date and time the solicitation was sent out, and any relevant information deemed appropriate by OB. Please ensure that copies of the electronic records are maintained, saved and available for submission to support compliance with RACP bidding requirements. The types of electronic records, which should be maintained and saved for submission should include, but is not limited to, copies of 1) emails - regular/standard and/or invitation to bid sent to the various contractors; 2) replies/queries; 3) emails/other written documentation, which indicate a decline to bid or will not bid status 4) documentation (i.e. bid forms, description of work, plans and specifications, etc.) emailed or made available for download as part of the bid solicitation; 5) transaction-type logs, which contain information, such as a) the work being solicited, b) the contractors solicited, and c) the date and time-stamp of when the solicitation was sent out; 6) screenshots; and 7) proposals received.

**48. OUR GENERAL CONTRACTOR / CONSTRUCTION MANAGER WAS SELECTED. MAY OUR GENERAL CONTRACTOR / CONSTRUCTION MANAGER SELF-BID ON THE CONSTRUCTION WORK WITHIN THE RACP-DEFINED PROJECT SCOPE?** Please be advised that any self-bidding election must be reviewed and approved by our Legal Department prior to its occurrence in any phase of the construction work within the RACP-defined project scope. To assist you better, please forward the following detailed information, which includes, but is not necessarily limited to:

- the exact method the bid solicitation will be conducted;
- who will be in charge of the bidding process;
- who will solicit the contractors;
- who will receive the proposals;
- what method will the proposals be submitted;

- who will open the proposals;
- who will be present at the opening of the proposals;
- who will conduct any negotiations (i.e. value engineering) prior to contract award;
- who will determine who the contract is awarded to, etc.
- Please note that the above requested information will need to be reviewed by our Legal Department. The review process could take a number of weeks before a decision is rendered. If a project pursues and/or completes any self-bidding process prior to the review and approval of OB Legal, the project does so at its own risk. Contracts that have deemed to be non-bid complaint are not eligible for reimbursements, nor match.

**49. ARE BID SOLICITATIONS REQUIRED FOR EQUIPMENT PURCHASES?** Bid solicitation is not required for equipment purchased separately. Please note that IF the purchase of equipment also includes installation services, the contract is NOT subject to PA Prevailing Wage Act. However, if the equipment contract does not include the installation, then the labor associated with the installation IS subject to PA Prevailing Wage Act AND the labor associated with the installation of the equipment must be bid (see item #42 above regarding bidding requirements). Please be advised that in both cases, the labor component cannot be disassociated from the purchased equipment. It is discretionary to the Office of the Budget what type of items fall into the equipment category and are RACP-eligible costs. Please be further advised that equipment and the labor associated with the installation of the equipment must both be present and directly related to the RACP-delineated scope.

**50. WE DO NOT HAVE ANY CERTIFIED PAYROLLS TO DEMONSTRATE COMPLIANCE WITH THE PENNSYLVANIA PREVAILING WAGE ACT. CAN THIS REQUIREMENT BE WAIVED TO FACILITATE THE RECEIPT OF THE STATE GRANT?** The Office of the Budget cannot grant waivers for the Prevailing Wage Act. All Grantees must comply with the act. Grantees that fail to abide by the Prevailing Wage Act do so at their own risk. Additionally, the Grantee/Sub-Grantee must provide a copy of the Department of Labor & Industry's Pennsylvania Prevailing Wage Determination Letter issued for the specific project to demonstrate compliance with the Prevailing Wage Act. The project should apply to the Department of Labor & Industry for the determination letter before construction begins. If necessary, the Department of Labor & Industry can issue determination letters after construction has begun. Prevailing wage information and forms can be found at: [Visit the Labor and Industry website to obtain Prevailing wage information and forms.](#)

**51. WE DO NOT HAVE ANY STEEL CERTIFICATES TO DEMONSTRATE COMPLIANCE WITH THE PENNSYLVANIA STEEL PROCUREMENT ACT. CAN YOU WAIVE THIS REQUIREMENT TO FACILITATE THE RECEIPT OF THE STATE GRANT?** The Office of the Budget cannot grant waivers for the Pennsylvania Steel Procurement Act unless the terms of the law change. All Grantees must comply with the Steel Procurement Act. Steel certificates noting milled/manufactured in the United States are required to document compliance with the Steel Act and must be supplied



for all structural steel. The appropriate ST form will be necessary for non-structural steel to be in compliance. If a Grantee fails to abide by the Pennsylvania Steel Procurement Act in anticipation of a waiver, it does so at its own risk.

**52. OUR CONSTRUCTION CONTRACTOR CANNOT OBTAIN THE 100% OF CONSTRUCTION COST BOND REQUIREMENT. CAN THIS BE WAIVED?** The requirement for 100% performance and payment bonds is a state law. The Office of the Budget cannot waive that requirement.

**53. ARE "ELIGIBLE COSTS" THOSE INCURRED AFTER THE LEGISLATIVE AUTHORIZATION DATE OR AFTER RECEIPT OF THE AWARD LETTER?** Costs are eligible after the legislative authorization date, assuming the costs meet all RACP requirements (bidding, prevailing wage, etc.). Your award letter included the Itemization Act number and the year your project received legislative approval. Your authorization date by month, day and year is listed in your Grant Agreement in Appendix B.

**54. DO I NEED A PROJECT SIGN OR ACKNOWLEDGEMENT FOR MY RACP FUNDED PROJECT?** Yes, the RACP grant agreement requires the acknowledgement of Commonwealth financial assistance. Depending on the timing of the RACP award, Commonwealth funding acknowledgment should be displayed upon the commencement of the project, but no later than the effective date of the project's grant agreement. The erected project sign should state "Financial Assistance provided by the Commonwealth of Pennsylvania, Honorable [name of current governor], Governor." Any publications concerning the project should also acknowledge Commonwealth financial assistance in the same manner. Acknowledgement of Commonwealth financial assistance may be combined with an acknowledgement of other funding sources on the project sign(s) and in project publications, provided that the acknowledgement of Commonwealth assistance shall be listed first and no less prominently than any other source.

## **PROJECT SCOPE**

**55. MAY I MAKE A COMPLEX RACP PROJECT SIMPLER?** The Office of the Budget may allow this in instances where certain items can be carefully carved out to make a streamlined project. In doing so, you must remember that the simplified project must obey the spirit of the law, in that construction activities must occur and full compliance with our requirements must be met. All changes in scope need to be sent in writing to the Office of the Budget for review and approval.

**56. CAN MY RACP SCOPE BE LIMITED TO ONLY LAND ACQUISITION COSTS?** The Capital Facilities Debt Enabling Act defines a redevelopment assistance capital project as the 'design and construction of facilities.' Therefore, the primary focus of all RACP projects should be on construction. At the discretion of the Office of the Budget, a portion of RACP funds may be

allowed for reimbursement of land acquisition costs. Generally, RACP funding is limited to approximately 20-30% of the total grant amount. For land acquisition costs to be reimbursable, the purchase date must occur after the authorization date associated with the itemized project and have RACP construction activity occur on the site.

## **REPORTING AND AUDITS**

- 57. I HAVE BEEN CONTACTED BY A STATE AUDITOR TO SET UP A CONFERENCE FOR AN AUDIT OF MY RACP PROJECT FOR WHICH I RECENTLY SENT IN MY LAST PAYMENT REQUEST. IS THIS NORMAL?** Yes. All RACP projects must have a legislatively mandated close-out audit performed to comply with Act 39 of 1993 and in accordance with Article 5 of your grant agreement.
- 58. THE LIST OF DOCUMENTS THE AUDITOR SENT ME TO HAVE AVAILABLE FOR THE CLOSE-OUT AUDIT INCLUDES DOCUMENTATION PREVIOUSLY SUPPLIED TO THE STATE CONSULTANT FOR MY PROJECT. DOES THE SAME DOCUMENTATION NEED TO BE REVIEWED AGAIN?** Yes. Keep in mind that the state consultant is part of the monitoring process. The auditors will need to examine documentation to be able to render an audit opinion. The Grantee/Sub-Grantee must keep all documentation concerning the project costs and RACP compliance and make it available during the close-out audit period. Many times, the list will include documentation previously submitted to the Office of the Budget in order to satisfy special conditions.
- 59. WHO WILL BE PERFORMING THE AUDIT OF MY RACP PROJECT?** A close-out audit will be performed by the Office of the Budget or its representative for all projects. The Grantee will not be required to pay for this audit.

**GUIDANCE ON STEEL CERTIFICATION RELATIVE TO THE  
REDEVELOPMENT ASSISTANCE CAPITAL PROGRAM (RACP)**

*Updated June 2022*

The following guidance is a clarification from the Office of the Budget (OB) regarding the requirements associated with the Pennsylvania Steel Products Procurement Act (SPPA) relative to the RACP program whose statutes are regulated under Act 1 of 1999, as amended. In the past, many a grantee has inquired about specific cases, and we were able to provide each individual project with specific directions. Additionally, we had only accepted the ST-4 form that the Department of General Services (DGS) had exclusively devised to address exceptions linked to the requirements of the SPPA in the handling of special cases or exceptions. Please note that cost consideration (or convenience) is not an acceptable justification that the ST-4 form can address. Filled out ST-4 forms premised on cost consideration will not be accepted by OB.

Effective immediately, OB will accept two more DGS ST forms (ST-2, ST-3) with some caveats, providing that the forms are properly filled out. The ST-1 form is NOT a valid option and shall NOT be accepted by OB. It is not necessary for the ST-2, ST-3, and ST-4 forms to be notarized. Please, be advised that this guidance is specifically tailored to suit the published and programmatic needs of OB as the overseer of RACP program. This is not a commonwealth-wide policy. Any attempt to impose this guidance on other state agencies is strongly discouraged.

Please, be aware that the aforementioned ST forms are acceptable only in cases where non-structural steel needs to be addressed. The DGS ST forms do not replace the steel certification forms associated with structural steel. It remains the responsibility of the project representatives to provide documented evidence that a non-structural steel product is not domestically produced in sufficient quantities.

OB shall continue to require that steel mill certifications be submitted to demonstrate compliance with the steel requirements. Please, be further advised that OB DOES NOT need to approve the ST forms prior to the start of the construction period. The ST forms need to be submitted to demonstrate that compliance, when and where necessary, has been met. The ST forms exceptions are displayed below. Please, contact us if you have any questions.

It is suggested that the certifications be collected at the time any steel for the project is purchased and delivered to ease the collection process.

Effective January 1, 2013, OB began utilizing the DGS Exempt Machinery and Equipment Steel Products listings as part of the RACP steel policy. DGS published a Statement of Policy - Steel Products Procurement in the Pennsylvania Bulletin Volume 43, Number 6 dated February 9, 2013 (See PA Bulletin #43, pages 85-86) that discussed their production of an annual list, based on their analysis of submitted ST-4 forms, which exempts certain steel products not produced domestically in sufficient quantity.

No other changes in RACP steel policy resulted from this new adjustment; consequently, the use of steel certificates for structural steel will still be required. Please note that the use of ST 2,

3, and 4, as requested for other steel products, will still be utilized unless an exemption based on the list has been formulated and forwarded to OB.

RACP Policy for Compliance with the Steel Products Procurement Act:

Two distinct approaches are presented below:

#### Structural Steel Products

Pursuant to the SPPA, OB will require a mill certificate containing the statement "milled, melted, and manufactured in the USA" for all structural steel products used on RACP projects. We shall deem as ineligible all contracts that are unable to demonstrate compliance via the submission of steel certifications. Therefore, the value of construction contracts associated with non-compliant steel will be removed (both materials and labor costs) from the scope of the project.

#### Non-Structural Steel Products

Pursuant to the SPPA, OB will require, either a mill certificate containing the statement "milled, melted, and manufactured in the USA" or the appropriate ST form or an **Exemption Request** to utilize the DGS current years' Final List of Exempt Machinery and Equipment Steel Products to demonstrate compliance associated with the non-structural steel products used on RACP projects. OB shall deem as ineligible all contracts that are unable to demonstrate compliance via the submission of steel certifications/ST **forms/Exemption Request** based on the DGS Exempt Machinery and Equipment Steel Products listing. Therefore, the value of construction contracts associated with non-compliant steel will be removed (both materials and labor costs) from the scope of the project.

Recycled products, melted from previously used steel, are acceptable, providing that adequate documentation from the supplier has been furnished. The supplier shall certify that the recycled steel product was produced in the USA.

Furthermore, the burden of proof for all non-structural steel products not produced domestically in sufficient quantities is still the project's responsibility to provide.

Please be aware that the acceptance of ST forms is contingent upon the form being fully filled-in and compliant with the submission guidelines for steel certifications for DGS projects (see attached) with the following exceptions:

- A. It is not necessary for the forms to be notarized. All ST forms must contain original signatures (i.e. not electronic or stamped).
- B. Any questions regarding steel certification submissions and/or compliance with the Act shall be submitted to OB (Scott Bowman - [scotbowman@pa.gov](mailto:scotbowman@pa.gov)).
- C. The Steel certification forms do NOT need to be submitted and approved by OB before the steel product arrives on site so as not to interfere with the project construction schedule.
- D. OB assumes responsibility for acceptance of the DGS ST forms in accordance

with this policy.

Completion of the ST-2, ST-3, and ST-4 forms shall follow the DGS directions attached to the form with the following exceptions:

- o ST forms do NOT need to be submitted and approved by OB before the steel product arrives on site so as not to interfere with the construction schedule.
- o RACP ME# assigned to the project shall be inserted in all areas requiring the DGS contract number (Line#5).
- o RACP official project name shall be inserted in all areas requiring the contract title (Line #6).

Note:

Acceptance of each ST form shall be determined by OB at its sole discretion. All documents and other information to be delivered in order to demonstrate compliance with the steel requirements shall be and are, in form, content and substance, subject to the approval of OB, which approval may be withheld or delayed at OB's discretion. OB reserves the right to reject all improperly filled out or unsupported ST forms.

Below are links to PDF copies of the three acceptable ST Forms that can be obtained from the RACP website:

- [ST-2 Steel Origin Certification: Non-Identifiable, Non-Structural Steel](#)
- [ST-3 75% U.S. Manufacture Certification](#)
- [ST-4 Not Domestically Manufactured: Prime Contractor](#) (only to be used when the items requested to be exempted are not found on the appropriate year's List of Exempt Machinery and Equipment Steel Products [see section below entitled "Year of DGS Exemption Listing to Use"])

To implement the RACP policy on Non-structural Steel Exemption Request utilizing the DGS's current years' Final List of Exempt Machinery and Equipment Steel Products, referred to as the "Exemption List", please follow the below requirements:

1. The Project must be under "active" construction (workers on site) on or AFTER 1/01/2013 (RACP effective date) to use the "Exemption List".
2. "Active" construction does not include performance of just "punch list" items.
3. Effective date is based on the "active" construction date and not the date the machinery and equipment were purchased.
4. There is no retroactive application of utilization of the "Exemption List".
5. No ST-4 form is required for a RACP Exemption Request based on the "Exemption List".
6. RACP Exemption Request (to utilize the "Exemption List") must come from a contractor involved in the construction of the project and be:
  - On Construction Company Letterhead.
  - Dated and Signed by appropriate company official (does not need to be notarized).
  - Should be addressed to Office of the Budget
  - Should contain RACP project name and/or ME #
  - Lists any/all machinery and equipment that the Company is requesting to have exempted from ST-4 documentation.

- All items listed on RACP Exemption Request letter must clearly match-up to an item on the appropriate year's "Exemption List" and the Exemption List year should be notated for each item.
- There can/may be multiple construction company RACP Exemption Request letters utilized for various machinery and equipment, as applicable, per project.
- Exemption Request can be submitted directly by the project to OB or through the State Assigned Consultant for their project.
- Any questions regarding the exemption request submission and/or compliance with the SPPA shall also be submitted to OB, to the attention of Scott Bowman, [Scotbowman@pa.gov](mailto:Scotbowman@pa.gov)

Year of DGS Exemption Listing to Use:

A project should be using the exemption listing for when they are in active construction. For example, if construction was active (and complete) in 2019 they would use the 2019 listing. If a project overlaps a calendar year, they should use the latest listing in which construction is active. For example, if construction is active in 2019 and 2020, they would use the 2020 listing.

If a project is phased, they should use the listing for the year they are in active construction for each phase. For example, if the first phase starts and ends in 2020 whereas the second phase starts and ends in 2021, the first phase would use the 2020 listing while the second phase would use the 2021 listing. If a phase overlaps a calendar year, follow the 1<sup>st</sup> paragraph above.

Among other items, the DGS web page for Steel Products Procurement Act information includes links for a copy of the Act; the current year's Final List of Exempt Machinery and Equipment Steel Products; the PA Bulletin's Steel Products Procurement Act Statement of Policy; and Frequently Asked Questions. Certain prior years DGS Exemption Lists are downloadable from the RACP website.

Please be aware that all other steel items not specifically exempted or that may require any type of interpretation would be discretionary to OB's policy. Be reminded that this exemption listing is not effective for structural steel.

Note:

Acceptance of each Exemption Request shall be determined by OB at its sole discretion. All documents and other information to demonstrate compliance with the steel requirements shall be in form, content, and substance, subject to the approval of OB, which approval may be withheld or delayed at OB's discretion. OB reserves the right to reject all improperly filled out or unsupported Exemption Request.

## DOCUMENT 004450 – WAGE DETERMINATION

## 1.1 GENERAL REQUIREMENTS

- A. The provisions of the Pennsylvania Prevailing Wage Act approved August 15, 1961 (P.L. 987) (43 P.S. § 165-14), and the Regulations issued pursuant thereto are hereby incorporated in and made part of the General Requirements of the Project. The Secretary of the Pennsylvania Department of Labor and Industry has predetermined the minimum wage rates, including contribution for employee benefits, which shall be paid to the workmen employed in the performance of this Project.

1. <https://www.dlsecureweb.pa.gov/PrevWage/Pages/Project.aspx?ID=181128&PageType=>

- B. The following provisions shall apply:

1. These provisions shall apply to all work performed on the Project by the Contractor, and to all work performed on the Project by all Subcontractors.
2. The Contractor shall insert in each of his subcontracts all of the stipulations contained in these required provisions and any other stipulations as may be required.
3. Workmen may not be employed on the work except in accordance with classifications set forth in the decision of the Secretary. In the event that additional or different classifications are necessary, the procedure set forth in Section 7 of the Regulations shall be followed.
4. Workmen employed or working on the Project shall be paid unconditionally, regardless of whether any contractual relationship exists or the nature of any contractual relationship which may be alleged to exist between any Contractor, Subcontractor and workmen, not less than once a week without deduction or rebate, on any account, either directly or indirectly except authorized deductions, the full amounts due at the time of payment, computed at the rates applicable to the time worked in the appropriate classification. Nothing in the Contract, the Act, or the Regulations shall prohibit the payment of more than the general prevailing minimum wage rates as determined by the Secretary to any workmen on public work.
5. The Contractor and each Subcontractor shall post for the entire construction period the wage determination decisions of the secretary, including the effective date of any changes thereof, in a prominent and easily accessible place at the project site and at such place used by them to pay workmen their wages. The posted notice must indicate:
  - a. Name of Project.
  - b. Name of public body the project is being constructed for.
  - c. The crafts and classifications of workmen listed in the Secretary's general prevailing minimum wage rate determination for the project.
  - d. The general prevailing minimum wage rates determined for each craft and classification and the effective date of any changes.
  - e. A statement advising workmen that if they have been paid less than the general prevailing minimum wage rate for their job classification or that the Contractor and/or Subcontractor are not complying with the Act or these Regulations in any manner whatsoever, they may file a protest in writing with the Secretary of Labor and Industry within three (3) months of the date of the occurrence, objecting to the payment to any Contractor to the extent of the amount or amounts due or to become due to when as wages for work performed on the public work project. Any workmen paid less than the rate specified in the contract shall have a civil right of action for the difference between the wage paid and the wage stipulated in the contract, which right must be exercised within six (6) months from the occurrence of the event creating such right.

6. The Contractor and all Subcontractors shall keep an accurate record showing the name, craft and/or classification, number of hours worked per day, and the actual hourly rate of wage paid, including employee benefits, to each workman employed by him in connection with the Work of this project. The record must include any deductions from each workman. The record shall be preserved for two (2) years from the date of payment and shall be open, at all reasonable hours, to the inspection of the public body awarding the contract, and to the Secretary or his duly authorized representative.
7. Apprentices shall be limited to numbers in accordance with a bona fide apprenticeship program registered with and approved by The Pennsylvania Apprenticeship and Training Council and only apprentices whose training and employment are in full compliance with The Apprenticeship and Training Act (43 P. S. §§ 90.1 - 90.10), approved July 14, 1961, and the regulations issued thereto shall be employed on the public work project. A workman using the tools of a craft who does not qualify as an apprentice within this subsection shall be paid the rate predetermined for journeymen in that particular craft or classification.
8. Wages shall be paid without any deductions except authorized deductions. Employers not party to a contract requiring contributions for employee benefits which the Secretary has determined to be included in the general prevailing minimum wage rate shall pay the monetary equivalent thereof directly to the workman.
9. Payment of compensation to workmen for work performed on public work on a lump sum basis, or a piece work system, or a price certain for the completion of a certain amount of work, or the production of a certain result shall be deemed a violation of the act and this subchapter, regardless of the average hourly earnings resulting therefrom.
10. The contract shall also provide that each contractor and each subcontractor shall file a statement each week and a final statement at the conclusion of the work on the contract with the contracting agency, under oath, and in form satisfactory to the Secretary, certifying that workmen have been paid wages in strict conformity with the provisions of the contract as prescribed by this section or if wages remain unpaid to set forth the amount of wages due and owing to each workman respectively.

## 1.2 WAGE DETERMINATION

- A. The Prevailing Minimum Wage Determination for this Project follows this Section, and is made part of this Project.
  1. A total of eight (8) sheets of the prevailing wage determination - Project Serial Number 24-02839 follow this Document 004450 - Wage Determination sheet.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 004450



**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

Project Name:	Aston Township Municipal Complex
Awarding Agency:	Aston Township
Contract Award Date:	5/15/2024
Serial Number:	24-02839
Project Classification:	Building
Determination Date:	3/20/2024
Assigned Field Office:	Philadelphia
Field Office Phone Number:	(215)560-1858
Toll Free Phone Number:	
Project County:	Delaware County

# BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 24-02839 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	6/1/2023		\$57.84	\$43.36	\$101.20
Boilermaker (Commercial, Institutional, and Minor Repair Work)	1/1/2019		\$29.26	\$18.48	\$47.74
Boilermakers	1/1/2023		\$51.27	\$35.30	\$86.57
Boilermakers	1/1/2024		\$52.10	\$35.72	\$87.82
Bricklayer	5/1/2023		\$47.50	\$31.42	\$78.92
Carpenter - Chief of Party (Surveying & Layout)	5/1/2023		\$50.57	\$29.02	\$79.59
Carpenter - Chief of Party (Surveying & Layout)	5/1/2024		\$52.58	\$29.02	\$81.60
Carpenter - Chief of Party (Surveying & Layout)	5/1/2025		\$54.59	\$29.02	\$83.61
Carpenter - Instrument Person (Surveying & Layout)	5/1/2023		\$43.97	\$29.02	\$72.99
Carpenter - Instrument Person (Surveying & Layout)	5/1/2024		\$45.72	\$29.02	\$74.74
Carpenter - Instrument Person (Surveying & Layout)	5/1/2025		\$47.47	\$29.02	\$76.49
Carpenter - Rodman (Surveying & Layout)	5/1/2023		\$21.99	\$20.62	\$42.61
Carpenter - Rodman (Surveying & Layout)	5/1/2024		\$22.86	\$20.62	\$43.48
Carpenter - Rodman (Surveying & Layout)	5/1/2025		\$23.74	\$20.62	\$44.36
Carpenters	5/1/2023		\$43.97	\$29.02	\$72.99
Carpenters	5/1/2024		\$45.72	\$29.02	\$74.74
Carpenters	5/1/2025		\$47.47	\$29.02	\$76.49
Cement Finishers & Plasterers	5/1/2022		\$38.57	\$32.39	\$70.96
Cement Masons	5/1/2023		\$44.20	\$32.96	\$77.16
Dockbuilder, Pile Drivers	5/1/2023		\$50.48	\$37.99	\$88.47
Dockbuilder, Pile Drivers	5/1/2024		\$52.98	\$37.99	\$90.97
Dockbuilder, Pile Drivers	5/1/2025		\$55.23	\$37.99	\$93.22
Dockbuilder, Pile Drivers	5/1/2026		\$56.98	\$37.99	\$94.97
Dockbuilder/Pile Driver Diver	5/1/2023		\$58.41	\$41.74	\$100.15
Dockbuilder/Pile Driver Diver	5/1/2024		\$61.54	\$41.74	\$103.28
Dockbuilder/Pile Driver Diver	5/1/2025		\$64.35	\$41.74	\$106.09
Dockbuilder/Pile Driver Diver	5/1/2026		\$66.54	\$41.74	\$108.28
Dockbuilder/pile driver tender	5/1/2023		\$50.48	\$37.99	\$88.47
Dockbuilder/pile driver tender	5/1/2024		\$52.98	\$37.99	\$90.97
Dockbuilder/pile driver tender	5/1/2025		\$55.23	\$37.99	\$93.22
Dockbuilder/pile driver tender	5/1/2026		\$56.98	\$37.99	\$94.97
Drywall Finisher	5/1/2023		\$38.77	\$31.12	\$69.89
Electricians	5/30/2022		\$47.64	\$35.14	\$82.78
Electricians	5/29/2023		\$49.24	\$36.04	\$85.28
Electricians	6/3/2024		\$50.17	\$38.87	\$89.04
Electricians	6/2/2025		\$52.71	\$40.07	\$92.78
Electricians	6/1/2026		\$55.25	\$41.28	\$96.53
Elevator Constructor	1/1/2023		\$66.21	\$43.64	\$109.85
Elevator Constructor	1/1/2024		\$68.97	\$44.70	\$113.67
Floor Coverer	5/1/2023		\$50.12	\$29.21	\$79.33
Floor Coverer	5/1/2024		\$52.19	\$29.21	\$81.40
Glazier	5/1/2023		\$46.68	\$36.62	\$83.30
Interior Finish	5/1/2023		\$34.60	\$25.80	\$60.40
Iron Workers (Bridge, Structural, Ornamental, Precast)	1/1/2023		\$50.70	\$39.51	\$90.21

# BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 24-02839 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Iron Workers (Riggers)	7/1/2023		\$42.53	\$34.14	\$76.67
Iron Workers (Rodman/Reinforcing)	7/1/2023		\$45.70	\$34.77	\$80.47
Laborers (Class 01 - See notes)	5/1/2022		\$33.35	\$25.65	\$59.00
Laborers (Class 01 - See notes)	5/1/2023		\$34.60	\$25.80	\$60.40
Laborers (Class 02 - See notes)	5/1/2022		\$36.70	\$27.00	\$63.70
Laborers (Class 02 - See notes)	5/1/2023		\$37.95	\$27.30	\$65.25
Laborers (Class 03 - See notes)	5/1/2022		\$33.77	\$25.83	\$59.60
Laborers (Class 03 - See notes)	5/1/2023		\$35.02	\$25.98	\$61.00
Laborers (Class 04 - See notes)	5/1/2022		\$33.77	\$25.83	\$59.60
Laborers (Class 04 - See notes)	5/1/2023		\$35.02	\$25.98	\$61.00
Laborers (Class 05 - See notes)	5/1/2022		\$33.35	\$25.65	\$59.00
Laborers (Class 05 - See notes)	5/1/2023		\$34.60	\$25.50	\$60.10
Landscape Laborer	5/1/2023		\$29.45	\$23.98	\$53.43
Marble Finisher	5/1/2022		\$38.27	\$29.15	\$67.42
Marble Finisher	5/1/2023		\$39.52	\$29.30	\$68.82
Marble Mason	5/1/2022		\$45.90	\$31.20	\$77.10
Marble Mason	5/1/2023		\$47.20	\$31.95	\$79.15
Mason Tender, Cement	5/1/2023		\$35.02	\$25.98	\$61.00
Millwright	5/1/2023		\$51.60	\$35.81	\$87.41
Millwright	5/1/2024		\$54.67	\$35.81	\$90.48
Millwright	5/1/2025		\$57.39	\$35.81	\$93.20
Millwright	5/1/2026		\$60.20	\$35.81	\$96.01
Operators (Building, Class 01 - See Notes)	5/1/2023		\$52.20	\$32.81	\$85.01
Operators (Building, Class 01A - See Notes)	5/1/2023		\$55.20	\$33.70	\$88.90
Operators (Building, Class 02 - See Notes)	5/1/2023		\$51.95	\$32.74	\$84.69
Operators (Building, Class 02A - See Notes)	5/1/2023		\$54.97	\$33.61	\$88.58
Operators (Building, Class 03 - See Notes)	5/1/2023		\$47.87	\$31.53	\$79.40
Operators (Building, Class 04 - See Notes)	5/1/2023		\$47.57	\$31.44	\$79.01
Operators (Building, Class 05 - See Notes)	5/1/2023		\$45.85	\$30.93	\$76.78
Operators (Building, Class 06 - See Notes)	5/1/2023		\$44.85	\$30.65	\$75.50
Operators (Building, Class 07A- See Notes)	5/1/2023		\$63.33	\$37.68	\$101.01
Operators (Building, Class 07B- See Notes)	5/1/2023		\$63.04	\$37.59	\$100.63
Painters Class 1 (see notes)	5/1/2023		\$42.32	\$32.91	\$75.23
Painters Class 4 (see notes)	5/1/2023		\$44.41	\$32.91	\$77.32
Plasterers	5/1/2023		\$39.32	\$32.64	\$71.96
plumber	5/1/2023		\$64.73	\$37.61	\$102.34
Pointers, Caulkers, Cleaners	5/1/2022		\$47.64	\$30.06	\$77.70
Pointers, Caulkers, Cleaners	5/1/2023		\$48.80	\$30.70	\$79.50
Roofers (Composition)	5/1/2022		\$41.48	\$33.87	\$75.35
Roofers (Shingle)	5/1/2021		\$30.50	\$21.55	\$52.05
Roofers (Shingle)	5/1/2023		\$32.85	\$22.10	\$54.95
Roofers (Slate & Tile)	5/1/2021		\$33.50	\$21.55	\$55.05
Roofers (Slate & Tile)	5/1/2023		\$35.85	\$22.10	\$57.95
Sheet Metal Workers	5/1/2022		\$55.75	\$47.28	\$103.03

**BUREAU OF LABOR LAW COMPLIANCE  
PREVAILING WAGES PROJECT RATES**

<b>Project: 24-02839 - Building</b>	<b>Effective Date</b>	<b>Expiration Date</b>	<b>Hourly Rate</b>	<b>Fringe Benefits</b>	<b>Total</b>
Sheet Metal Workers	5/1/2023		\$57.31	\$48.97	\$106.28
Sign Makers and Hangars	7/15/2022		\$30.54	\$24.35	\$54.89
Sign Makers and Hangars	7/15/2023		\$31.76	\$24.63	\$56.39
Sprinklerfitters	1/1/2023		\$62.23	\$31.99	\$94.22
Steamfitters	5/1/2023		\$67.37	\$41.99	\$109.36
Stone Masons	5/1/2022		\$45.90	\$31.20	\$77.10
Stone Masons	5/1/2023		\$47.20	\$31.95	\$79.15
Terrazzo Finisher	5/1/2022		\$42.44	\$27.71	\$70.15
Terrazzo Finisher	5/1/2023		\$43.75	\$27.86	\$71.61
Terrazzo Grinder	5/1/2022		\$42.71	\$27.71	\$70.42
Terrazzo Grinder	5/1/2023		\$44.02	\$27.86	\$71.88
Terrazzo Mechanics	5/1/2022		\$48.81	\$29.46	\$78.27
Terrazzo Mechanics	5/1/2023		\$50.26	\$29.56	\$79.82
Tile Finisher	5/1/2022		\$38.27	\$29.15	\$67.42
Tile Finisher	5/1/2023		\$39.52	\$29.30	\$68.82
Tile Setter	5/1/2022		\$48.81	\$29.46	\$78.27
Tile Setter	5/1/2023		\$50.26	\$29.56	\$79.82
Truckdriver class 1(see notes)	5/1/2022		\$35.60	\$20.74	\$56.34
Truckdriver class 1(see notes)	5/1/2023		\$36.29	\$21.55	\$57.84
Truckdriver class 2 (see notes)	5/1/2022		\$35.70	\$20.74	\$56.44
Truckdriver class 2 (see notes)	5/1/2023		\$36.39	\$21.55	\$57.94
Truckdriver class 3 (see notes)	5/1/2022		\$35.95	\$20.74	\$56.69
Truckdriver class 3 (see notes)	5/1/2023		\$36.64	\$21.55	\$58.19
Window Film / Tint Installer	6/1/2019		\$24.52	\$12.08	\$36.60

# BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 24-02839 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter - Chief of Party (Surveying & Layout)	5/1/2023		\$63.24	\$29.06	\$92.30
Carpenter - Chief of Party (Surveying & Layout)	5/1/2024		\$65.19	\$29.06	\$94.25
Carpenter - Chief of Party (Surveying & Layout)	5/1/2025		\$67.15	\$29.06	\$96.21
Carpenter - Chief of Party (Surveying & Layout)	5/1/2026		\$69.10	\$29.06	\$98.16
Carpenter - Instrument Person (Surveying & Layout)	5/1/2023		\$54.99	\$29.06	\$84.05
Carpenter - Instrument Person (Surveying & Layout)	5/1/2024		\$56.69	\$29.06	\$85.75
Carpenter - Instrument Person (Surveying & Layout)	5/1/2025		\$58.39	\$29.06	\$87.45
Carpenter - Instrument Person (Surveying & Layout)	5/1/2026		\$60.09	\$29.06	\$89.15
Carpenter - Rodman (Surveying & Layout)	5/1/2023		\$43.99	\$22.41	\$66.40
Carpenter - Rodman (Surveying & Layout)	5/1/2024		\$45.35	\$22.41	\$67.76
Carpenter - Rodman (Surveying & Layout)	5/1/2025		\$46.71	\$22.41	\$69.12
Carpenter - Rodman (Surveying & Layout)	5/1/2026		\$48.07	\$22.41	\$70.48
Carpenter	5/1/2023		\$54.99	\$29.06	\$84.05
Carpenter	5/1/2024		\$56.69	\$29.06	\$85.75
Carpenter	5/1/2025		\$58.49	\$29.06	\$87.55
Carpenter	5/1/2026		\$60.19	\$29.06	\$89.25
Cement Masons	5/1/2023		\$43.20	\$32.91	\$76.11
Dockbuilder, Pile Drivers	5/1/2023		\$50.48	\$37.99	\$88.47
Dockbuilder, Pile Drivers	5/1/2024		\$52.98	\$37.99	\$90.97
Dockbuilder, Pile Drivers	5/1/2025		\$55.23	\$37.99	\$93.22
Dockbuilder, Pile Drivers	5/1/2026		\$56.98	\$37.99	\$94.97
Dockbuilder/Pile Driver Diver	5/1/2023		\$58.41	\$41.74	\$100.15
Dockbuilder/Pile Driver Diver	5/1/2024		\$61.54	\$41.74	\$103.28
Dockbuilder/Pile Driver Diver	5/1/2025		\$64.35	\$41.74	\$106.09
Dockbuilder/Pile Driver Diver	5/1/2026		\$66.54	\$41.74	\$108.28
Dockbuilder/pile driver tender	5/1/2023		\$50.48	\$37.99	\$88.47
Dockbuilder/pile driver tender	5/1/2024		\$52.98	\$37.99	\$90.97
Dockbuilder/pile driver tender	5/1/2025		\$55.23	\$37.99	\$93.22
Dockbuilder/pile driver tender	5/1/2026		\$56.98	\$37.99	\$94.97
Electric Lineman	5/30/2022		\$59.17	\$31.48	\$90.65
Electric Lineman	5/29/2023		\$60.48	\$32.77	\$93.25
Electric Lineman	6/3/2024		\$62.07	\$33.96	\$96.03
Iron Workers (Bridge, Structural, Ornamental, Precast)	1/1/2023		\$50.70	\$39.51	\$90.21
Iron Workers (Riggers)	7/1/2023		\$42.53	\$34.14	\$76.67
Iron Workers (Rodman/Reinforcing)	7/1/2023		\$45.70	\$34.77	\$80.47
Laborers (Class 01 - See notes)	5/1/2022		\$36.30	\$27.20	\$63.50
Laborers (Class 01 - See notes)	5/1/2023		\$37.55	\$27.45	\$65.00
Laborers (Class 02 - See notes)	5/1/2022		\$36.50	\$27.20	\$63.70
Laborers (Class 02 - See notes)	5/1/2023		\$37.75	\$27.45	\$65.20
Laborers (Class 03 - See notes)	5/1/2022		\$36.50	\$27.20	\$63.70
Laborers (Class 03 - See notes)	5/1/2023		\$37.75	\$27.45	\$65.20
Laborers (Class 04 - See notes)	5/1/2022		\$31.10	\$27.20	\$58.30
Laborers (Class 04 - See notes)	5/1/2023		\$32.35	\$27.45	\$59.80
Laborers (Class 05 - See notes)	5/1/2022		\$37.15	\$27.20	\$64.35

# BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 24-02839 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 05 - See notes)	5/1/2023		\$38.40	\$27.45	\$65.85
Laborers (Class 06 - See notes)	5/1/2022		\$37.20	\$27.20	\$64.40
Laborers (Class 06 - See notes)	5/1/2023		\$38.40	\$27.45	\$65.85
Laborers (Class 07 - See notes)	5/1/2022		\$37.05	\$27.20	\$64.25
Laborers (Class 07 - See notes)	5/1/2023		\$38.30	\$27.45	\$65.75
Laborers (Class 08 - See notes)	5/1/2022		\$36.80	\$27.20	\$64.00
Laborers (Class 08 - See notes)	5/1/2023		\$38.05	\$27.45	\$65.50
Laborers (Class 09 - See notes)	5/1/2022		\$36.65	\$27.20	\$63.85
Laborers (Class 09 - See notes)	5/1/2023		\$37.90	\$27.45	\$65.35
Laborers (Class 10- See notes)	5/1/2022		\$36.80	\$27.20	\$64.00
Laborers (Class 10- See notes)	5/1/2023		\$38.05	\$27.45	\$65.50
Laborers (Class 11 -See Notes)	5/1/2022		\$36.70	\$27.20	\$63.90
Laborers (Class 11 -See Notes)	5/1/2023		\$37.95	\$27.45	\$65.40
Laborers (Class 12 -See Notes)	5/1/2022		\$38.40	\$27.20	\$65.60
Laborers (Class 12 -See Notes)	5/1/2023		\$39.65	\$27.45	\$67.10
Laborers (Class 13 -See Notes)	5/1/2022		\$40.43	\$27.20	\$67.63
Laborers (Class 13 -See Notes)	5/1/2023		\$41.65	\$27.45	\$69.10
Laborers (Class 14 -See Notes)	5/1/2022		\$36.55	\$27.20	\$63.75
Laborers (Class 14 -See Notes)	5/1/2023		\$38.25	\$27.45	\$65.70
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2022		\$30.17	\$19.18	\$49.35
Laborers Utility (PGW ONLY) (Flagperson)	5/1/2023		\$31.42	\$19.43	\$50.85
Laborers Utility (PGW ONLY)	5/1/2022		\$37.20	\$19.18	\$56.38
Laborers Utility (PGW ONLY)	5/1/2023		\$38.45	\$19.43	\$57.88
Landscape Laborer	5/1/2022		\$27.73	\$23.65	\$51.38
Landscape Laborer	5/1/2023		\$29.03	\$23.80	\$52.83
Millwright	5/1/2023		\$51.60	\$35.81	\$87.41
Millwright	5/1/2024		\$54.67	\$35.81	\$90.48
Millwright	5/1/2025		\$57.39	\$35.81	\$93.20
Millwright	5/1/2026		\$60.20	\$35.81	\$96.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2023		\$52.20	\$32.81	\$85.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2024		\$53.36	\$33.65	\$87.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2025		\$54.52	\$34.49	\$89.01
Operators Class 01 - See Notes (Building, Heavy, Highway)	5/1/2026		\$55.67	\$35.34	\$91.01
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2023		\$55.20	\$33.70	\$88.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2024		\$56.37	\$34.53	\$90.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2025		\$57.52	\$35.38	\$92.90
Operators Class 01a - See Notes (Building, Heavy, Highway)	5/1/2026		\$58.68	\$36.22	\$94.90
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2023		\$51.95	\$32.74	\$84.69

# BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 24-02839 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2024		\$53.11	\$33.58	\$86.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2025		\$54.27	\$34.42	\$88.69
Operators Class 02 - See Notes (Building, Heavy, Highway)	5/1/2026		\$55.43	\$35.26	\$90.69
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2023		\$54.97	\$33.61	\$88.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2024		\$56.13	\$34.45	\$90.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2025		\$57.29	\$35.29	\$92.58
Operators Class 02a - See Notes (Building, Heavy, Highway)	5/1/2026		\$58.44	\$36.14	\$94.58
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2023		\$47.87	\$31.53	\$79.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2024		\$49.03	\$32.37	\$81.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2025		\$50.18	\$33.22	\$83.40
Operators Class 03 - See Notes (Building, Heavy, Highway)	5/1/2026		\$51.34	\$34.06	\$85.40
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2023		\$47.57	\$31.44	\$79.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2024		\$48.73	\$32.28	\$81.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2025		\$49.88	\$33.13	\$83.01
Operators Class 04 - See Notes (Building, Heavy, Highway)	5/1/2026		\$51.04	\$33.97	\$85.01
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2023		\$45.85	\$30.93	\$76.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2024		\$47.00	\$31.78	\$78.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2025		\$48.16	\$32.62	\$80.78
Operators Class 05 - See Notes (Building, Heavy, Highway)	5/1/2026		\$49.32	\$33.46	\$82.78
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2023		\$44.85	\$30.65	\$75.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2024		\$46.02	\$31.48	\$77.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2025		\$47.17	\$32.33	\$79.50
Operators Class 06 - See Notes (Building, Heavy, Highway)	5/1/2026		\$48.34	\$33.16	\$81.50
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2023		\$63.33	\$37.68	\$101.01
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2024		\$64.80	\$38.61	\$103.41
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2025		\$66.26	\$39.55	\$105.81
Operators Class 07 (A) - See Notes (Building, Heavy, Highway)	5/1/2026		\$67.73	\$40.48	\$108.21

# BUREAU OF LABOR LAW COMPLIANCE PREVAILING WAGES PROJECT RATES

Project: 24-02839 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2023		\$63.04	\$37.59	\$100.63
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2024		\$64.50	\$38.53	\$103.03
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2025		\$65.97	\$39.46	\$105.43
Operators Class 07 (B) - See Notes (Building, Heavy, Highway)	5/1/2026		\$67.44	\$40.39	\$107.83
Painters Class 2 (see notes)	2/1/2023		\$48.82	\$32.09	\$80.91
Painters Class 2 (see notes)	2/1/2024		\$49.57	\$33.34	\$82.91
Painters Class 3 (see notes)	2/1/2023		\$59.78	\$32.13	\$91.91
Painters Class 3 (see notes)	2/1/2024		\$60.53	\$33.38	\$93.91
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2022		\$61.34	\$40.28	\$101.62
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2023		\$64.00	\$41.68	\$105.68
Steamfitters (Heavy and Highway - Gas Distribution)	3/4/2024		\$64.00	\$41.83	\$105.83
Truckdriver class 1(see notes)	5/1/2022		\$35.45	\$20.74	\$56.19
Truckdriver class 1(see notes)	5/1/2023		\$36.14	\$21.55	\$57.69
Truckdriver class 2 (see notes)	5/1/2022		\$35.55	\$20.74	\$56.29
Truckdriver class 2 (see notes)	5/1/2023		\$36.24	\$21.55	\$57.79
Truckdriver class 3 (see notes)	5/1/2022		\$35.80	\$20.74	\$56.54
Truckdriver class 3 (see notes)	5/1/2023		\$36.49	\$21.55	\$58.04



## DOCUMENT 004460 – CONTRACTOR’S QUALIFICATION STATEMENT

THE UNDERSIGNED certifies under oath the truth and correctness of all statements and of all answers to questions made hereinafter.

**SUBMITTED TO:** Aston Township  
2 New Road  
Aston, PA 19014

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

**ADDRESS:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**PRINCIPALS NAME:** \_\_\_\_\_

**MAILING ADDRESS:**  
(If different than above) \_\_\_\_\_

**CHECK** - Corporation ( ), Partnership ( ), Individual ( ), Joint Venture ( ) or  
Other ( )

**DUNN AND BRADSTREET NUMBER** \_\_\_\_\_

1.0 How long has your organization been in business as a Contractor?

2.0 How many years has your organization been in business under its present business name?

2.1 Under what other or former names has your organization operated?

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

3.0 If a Corporation answer the following:

3.1 Date of incorporation: \_\_\_\_\_

3.2 State of incorporation: \_\_\_\_\_

3.3 President's Name: \_\_\_\_\_

3.4 Vice-president's Names: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3.5 Secretary's Name: \_\_\_\_\_

3.6 Treasurer's Name: \_\_\_\_\_

4.0 If an Individual or a Partnership answer the following:

4.1 Date of organization: \_\_\_\_\_

4.2 Name and address of all partners (State whether General or Limited Partnership):

_____	_____
_____	_____
_____	_____
_____	_____

5.0 If other than a Corporation or Partnership, describe organization and name Principals:

6.0 List the States and the categories in which your organization is legally qualified to do business. Indicate registration or license numbers if applicable.

7.0 Organization normally performs the following type of work:

8.0 Have you ever failed to complete any contract work that was awarded to you? Yes ( ) or No ( )

If your answer was YES fully describe the circumstances surrounding that failure.

9.0 Are you currently involved or during the past 5 years been involved with litigation with any current or previous customer either as plaintiff or defendant? Yes ( ) or NO ( )

If your answer was YES state the nature and status of the litigation and the stated reason for the dispute.

10.0 Within the last five years, has any Officer or Partner of your organization been an Officer or Partner of any other organization that defaulted on a contract? Yes ( ) or No ( )

If YES, attach a separate sheet explaining the default.

11.0 How would you best describe your company? \_\_\_\_\_

How many employees a currently on your company payroll?

Full Time \_\_\_\_\_ Part Time \_\_\_\_\_

12.0 On a separate sheet of paper list all major contracts that your organization has in process giving the Name of the Project, the Owners Name, the Architect/Engineer, the Contract Amount, Percent Complete and the Scheduled Completion Date.

13.0 On a separate sheet of paper list the major projects your organization has completed in the past five years giving the Name of the Project, the Owners Name, the Date of Completion and the Contract Amount.

14.0 On a separate sheet of paper list the construction experience of the key individuals of your organization.

15.0 On a separate sheet of paper list the rolling stock and powered equipment that your organization owns or rents. Annotate the type and the quantities of the equipment that you intend to use on this job site.

16.0 Trade References:

1.	_____	2.	_____
	_____		_____
	_____		_____
	_____		_____
3.	_____	4.	_____
	_____		_____
	_____		_____
	_____		_____

17.0 Bank References:

1.	_____
	_____
	_____
	_____
2.	_____
	_____
	_____
	_____

18.0 Name of Bonding Company with the name and address of agent:

Name: \_\_\_\_\_

Agent: \_\_\_\_\_

18.1 Current bonding capacity available to Contractor \$ \_\_\_\_\_

19.0 Document 004470 - Financial Qualifications Form is not required to be included with the Bid; however, Aston Township reserves the right to require this data when considering and evaluating the bids.

The undersigned certifies that he/she is duly authorized to provide the above information on behalf of the firm and that the information provided is true and correct. The undersigned also hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the Owner in verification of the recitals comprising this Statement of Bidder's Financial Qualifications:

**NAME OF BIDDER:**

**AUTHORIZED REPRESENTATIVE**

(Typed):

**AUTHORIZED REPRESENTATIVE**

(Signature):

**TITLE:**

**ADDRESS OF BIDDER:**

**PHONE NUMBER:**

Sworn to and Subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_, 2018.

My Commission expires \_\_\_\_\_. NOTARY PUBLIC \_\_\_\_\_.

END OF DOCUMENT 004460

## 1 SECTION 004470 – FINANCIAL QUALIFICATIONS

2 This Financial Qualifications Form may be required by the Aston Township during the evaluation of bids. All  
3 blanks are to be filled in with complete and accurate information. Use additional pages where necessary to provide  
4 comprehensive responses to each item. Where the item is not relevant, the blanks are to be filled in with “Not Ap-  
5 plicable” or a similar statement.

6 **PART ONE – ASSETS**

## 7 1. Current Assets

8	1a. Cash On Hand	\$	_____
9	1b. Cash In Bank	\$	_____
10	1c. Notes Receivable		
11	Due Within 90 Days (Hypothecated)	\$	_____
12	1d. Notes Receivable		
13	Due After 90 Days (Hypothecated)	\$	_____
14	1e. Notes Receivable, Past Due (Hypothecated)	\$	_____
15	1f. Deduct Estimated Un-collectible Notes Receivable	\$	(_____)
16	1g. Completed Contract Accounts Receivable	\$	_____
17	1h. Deferred & Unbilled Accounts Receivable	\$	_____
18	1j. Unfinished Accounts Receivable	\$	_____
19	1k. Deduct Estimated Un-collectible Accts Receivable	\$	(_____)
20	1m. Other Current Assets	\$	_____
21	1n. TOTAL CURRENT ASSETS (sum of 1a - 1m)		\$ _____

## 22 2. Investments

23	2a. Stocks & Bond Investments (Market Value)	\$	_____
24	2b. Other Investments	\$	_____
25	2c. TOTAL INVESTMENTS (sum of 2a and 2b)		\$ _____

26

1	3. Fixed Assets		
2	3a. Land Value	\$	_____
3	3b. Buildings Value (Depreciated)	\$	_____
4	3c. Machinery and Equipment Value (Depreciated)	\$	_____
5	3d. Furniture and Fixtures (Depreciated)	\$	_____
6	3e. Other Fixed Assets	\$	_____
7	3f. TOTAL FIXED ASSETS (sum of 3a – 3e)		\$ _____
8	4. Other Assets		
9	4a. Intangible Assets, Goodwill, and Patents	\$	_____
10	4b. Deferred Charges and Prepaid Expenses	\$	_____
11	4c. Restricted Cash	\$	_____
12	4d. TOTAL OTHER ASSETS (sum of 4a – 4c)		\$ _____
13	5. TOTAL ASSETS		
14	(sum of 1n + 2c + 3f + 4d)		\$ _____

15 **PART TWO – LIABILITIES**

16	6. Current Notes Payable		
17	6a. Notes Payable to Banks	\$	_____
18	6b. Notes Payable for Machinery and Equipment	\$	_____
19	6c. Notes Payable for Merchandise and Raw Materials	\$	_____
20	6d. Other Notes Payable	\$	_____
21	6e. TOTAL NOTES PAYABLE (sum of 6a – 6d)		\$ _____
22	7. Current Liabilities		
23	7a. Accounts Payable, Not Past Due	\$	_____
24	7b. Accounts Payable, Past Due	\$	_____
25	7c. Unfinished Subcontract Costs	\$	_____
26	7d. Accrued Expenses (Interest, Wages, Etc)	\$	_____
27	7e. Advances from Stockholders, Directors, and Others	\$	_____
28	7f. State and Federal Taxes	\$	_____
29	7g. Long Term Debt (Due within one year)	\$	_____
30	7h. Estimated Liability for Damages (indeterminate in		
31	amount but due within one year)	\$	_____
32	7j. Other Current Liabilities	\$	_____
33	7k. TOTAL CURRENT LIABILITIES (sum of 7a – 7j)		\$ _____
34			

1	8. Deferred Credits		
2	8a. Deferred Credits	\$ _____	
3	8b. Deferred Income (Uncompleted Contracts)	\$ _____	
4	8c. Unamortized Bond Premium	\$ _____	
5	8d. TOTAL DEFERRED CREDITS (sum of 8a – 8c)		\$ _____
6	9. Funded Debt		
7	9a. Mortgages Payable	\$ _____	
8	9b. Other Funded Debt Payable	\$ _____	
9	9c. TOTAL FUNDED DEBT (sum of 9a + 9b)		\$ _____
10	10. Stock		
11	10a. Preferred Stock	\$ _____	
12	10b. Common Stock	\$ _____	
13	10c. TOTAL STOCK (sum of 10a + 10b)		\$ _____
14	11. Surplus		
15	11a. Capital Surplus	\$ _____	
16	11b. Earned Surplus	\$ _____	
17	11c. TOTAL SURPLUS (sum of 11a + 11b)		\$ _____
18	12. TOTAL LIABILITIES, CAPITAL, AND SURPLUS		
19	(sum of 6e + 7k + 8d + 9c + 10c + 11c)		\$ _____
20			

The undersigned certifies that he/she is duly authorized to provide the above information on behalf of the firm and that the information provided is true and correct. The undersigned also hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the Owner in verification of the recitals comprising this Statement of Bidder's Financial Qualifications:

**NAME OF BIDDER:**

**AUTHORIZED REPRESENTATIVE**  
(Typed):

**AUTHORIZED REPRESENTATIVE**  
(Signature):

**TITLE:**

**ADDRESS OF BIDDER:**

**PHONE NUMBER:**

Sworn to and Subscribed before me this \_\_\_\_\_ day of \_\_\_\_\_ 2024.

My Commission expires \_\_\_\_\_. NOTARY PUBLIC \_\_\_\_\_.

END OF SECTION 004470



1 DOCUMENT 006000 - STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

2 1.1 STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

3 A. AIA Document A101, "Standard Form of Agreement Between Owner and Contractor," is hereby incorporated  
4 into the Procurement and Contracting Requirements by reference.

5 1. A copy of AIA Document A101, " Standard Form of Agreement Between Owner and Contractor ", is  
6 bound in this Project Manual.

7 END OF DOCUMENT 006000



# AIA® Document A101® – 2017

## **Standard Form of Agreement Between Owner and Contractor** where the basis of payment is a Stipulated Sum

**AGREEMENT** made as of the     day of     in the year  
(In words, indicate day, month and year.)

**BETWEEN** the Owner:  
(Name, legal status, address and other information)

Aston Township  
2 New Road  
Aston, PA 19014

and the Contractor:  
(Name, legal status, address and other information)

for the following Project:  
(Name, location and detailed description)

Aston Township Municipal Complex  
3264 Concord Road  
Aston, PA 19014

The Architect:  
(Name, legal status, address and other information)

Bernardon LLC  
10 North High Street  
Suite 310  
West Chester, PA 19380

The Owner and Contractor agree as follows.

### **ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Init.

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**User Notes:**

(1933067065)

## TABLE OF ARTICLES

1	THE CONTRACT DOCUMENTS
2	THE WORK OF THIS CONTRACT
3	DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
4	CONTRACT SUM
5	PAYMENTS
6	DISPUTE RESOLUTION
7	TERMINATION OR SUSPENSION
8	MISCELLANEOUS PROVISIONS
9	ENUMERATION OF CONTRACT DOCUMENTS

## EXHIBIT A INSURANCE AND BONDS

### ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

### ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

### ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

*(Check one of the following boxes.)*

- ☐ The date of this Agreement.
- ☐ A date set forth in a notice to proceed issued by the Owner.
- ☐ Established as follows:  
*(Insert a date or a means to determine the date of commencement of the Work.)*

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

#### § 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

*(Check one of the following boxes and complete the necessary information.)*

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

**Portion of Work**

**Substantial Completion Date**

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

**ARTICLE 4 CONTRACT SUM**

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be (\$ ), subject to additions and deductions as provided in the Contract Documents.

**§ 4.2 Alternates**

§ 4.2.1 Alternates, if any, included in the Contract Sum:

**Item**

**Price**

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.  
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

**Item**

**Price**

**Conditions for Acceptance**

§ 4.3 Allowances, if any, included in the Contract Sum:  
(Identify each allowance.)

**Item**

**Price**

§ 4.4 Unit prices, if any:

(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

**Item**

**Units and Limitations**

**Price per Unit (\$0.00)**

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

TIME IS OF THE ESSENCE OF IN CONTRACTOR'S PERFORMANCE OF THE WORK. CONTRACTOR ACKNOWLEDGES THAT: 1) OWNER IS RELYING ON TIMELY PERFORMANCE OF THE WORK IN ORDER TO WRAP UP ITS OPERATIONS AT ITS CURRENT LOCATIONS AND CONSOLIDATE THEM AT THE NEW BUILDING TO BE CONSTRUCTED HEREUNDER; 2) THAT OWNER HAS ESTABLISHED THE SUBSTANTIAL COMPLETION DATE AND THE FINAL COMPLETION DATE IN ORDER TO GIVE IT SUFFICIENT TIME TO WRAP UP ITS OPERATIONS AT ITS CURRENT LOCATION AND RELOCATE TO THE NEW BUILDING TO BE CONSTRUCTED HEREUNDER; 3) OWNER IS A TENANT AT ITS CURRENT LOCATIONS, AND ANY DELAY IN COMPLETION OF THE WORK IS LIKELY TO PLACE OWNER IN HOLDOVER STATUS AS TO ITS EXISTING LEASES; AND 4) THE AMOUNT OF DAMAGE LANDLORD MAY SUFFER IN THE EVENT THAT CONTRACTOR FAILS TO TIMELY COMPLETE THE WORK IS

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User Notes:

(1933067065)

SPECULATIVE AND MAY BE SUBJECT TO FACTORS THAT MAKE ACTUAL DAMAGES IMPOSSIBLE TO PROVE. AS SUCH, CONTRACTOR AGREES TO PAY TO OWNER LIQUIDATED DAMAGES IN THE AMOUNT OF ONE THOUSAND DOLLARS (\$1,000.00) PER DAY IN THE EVENT OF ANY DELAY IN SUBSTANTIAL COMPLETION OR FINAL COMPLETION OF THE WORK. THE FOREGOING AMOUNT IS AN ESTIMATE OF OWNER'S ACTUAL DAMAGES FROM ANY SUCH DELAY, AND CONTRACTOR CONSENTS TO ITS REASONABLENESS. NOTHING SET FORTH HEREIN SHALL PRECLUDE OWNER FROM SEEKING ACTUAL PROVABLE DAMAGES FOR DELAY IN EXCESS OF THE AFOREMENTIONED AMOUNT SHOULD THEY OCCUR

**§ 4.6 Other:**

*(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)*

**ARTICLE 5 PAYMENTS**

**§ 5.1 Progress Payments**

**§ 5.1.1** Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

**§ 5.1.2** The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

**§ 5.1.3** Provided that an Application for Payment is received by the Architect not later than the    day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the    day of the    month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than    (    ) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

**§ 5.1.4** Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

**§ 5.1.5** Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

**§ 5.1.6** In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

**§ 5.1.6.1** The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

**§ 5.1.6.2** The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

#### **§ 5.1.7 Retainage**

**§ 5.1.7.1** For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

*(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)*

**§ 5.1.7.1.1** The following items are not subject to retainage:

*(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)*

**§ 5.1.7.2** Reduction or limitation of retainage, if any, shall be as follows:

*(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)*

**§ 5.1.7.3** Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:

*(Insert any other conditions for release of retainage upon Substantial Completion.)*

**§ 5.1.8** If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

**§ 5.1.9** Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

#### **§ 5.2 Final Payment**

**§ 5.2.1** Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

**§ 5.2.2** The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

#### **§ 5.3 Interest**

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.



*(Insert rate of interest agreed upon, if any.)*

%

## **ARTICLE 6 DISPUTE RESOLUTION**

### **§ 6.1 Initial Decision Maker**

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

*(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)*

### **§ 6.2 Binding Dispute Resolution**

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

*(Check the appropriate box.)*

- ☐ Arbitration pursuant to Section 15.4 of AIA Document A201–2017
- ☐ Litigation in a court of competent jurisdiction
- ☐ Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

## **ARTICLE 7 TERMINATION OR SUSPENSION**

**§ 7.1** The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

**§ 7.1.1** If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:

*(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)*

**§ 7.2** The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

## **ARTICLE 8 MISCELLANEOUS PROVISIONS**

**§ 8.1** Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

**§ 8.2** The Owner's representative:

*(Name, address, email address, and other information)*

§ 8.3 The Contractor's representative:  
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

**§ 8.5 Insurance and Bonds**

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

*(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)*

§ 8.7 Other provisions:

**ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS**

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction
- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:

*(Insert the date of the E203-2013 incorporated into this Agreement.)*

.5 Drawings

Number

Title

Date

.6 Specifications

Init.



Section	Title	Date	Pages
---------	-------	------	-------

.7 Addenda, if any:

Number	Date	Pages
--------	------	-------

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:  
*(Check all boxes that apply and include appropriate information identifying the exhibit where required.)*

☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:  
*(Insert the date of the E204-2017 incorporated into this Agreement.)*

☐ The Sustainability Plan:

Title	Date	Pages
-------	------	-------

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
----------	-------	------	-------

.9 Other documents, if any, listed below:  
*(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)*

This Agreement entered into as of the day and year first written above.

\_\_\_\_\_  
**OWNER** *(Signature)*

\_\_\_\_\_  
*(Printed name and title)*

\_\_\_\_\_  
**CONTRACTOR** *(Signature)*

\_\_\_\_\_  
*(Printed name and title)*

Init.

# **Additions and Deletions Report for**

## **AIA® Document A101® – 2017**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

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### **PAGE 1**

Aston Township  
2 New Road  
Aston, PA 19014

...

Aston Township Municipal Complex  
3264 Concord Road  
Aston, PA 19014

...

Bernardon LLC  
10 North High Street  
Suite 310  
West Chester, PA 19380

### **PAGE 3**

TIME IS OF THE ESSENCE OF IN CONTRACTOR'S PERFORMANCE OF THE WORK. CONTRACTOR ACKNOWLEDGES THAT: 1) OWNER IS RELYING ON TIMELY PERFORMANCE OF THE WORK IN ORDER TO WRAP UP ITS OPERATIONS AT ITS CURRENT LOCATIONS AND CONSOLIDATE THEM AT THE NEW BUILDING TO BE CONSTRUCTED HEREUNDER; 2) THAT OWNER HAS ESTABLISHED THE SUBSTANTIAL COMPLETION DATE AND THE FINAL COMPLETION DATE IN ORDER TO GIVE IT SUFFICIENT TIME TO WRAP UP ITS OPERATIONS AT ITS CURRENT LOCATION AND RELOCATE TO THE NEW BUILDING TO BE CONSTRUCTED HEREUNDER; 3) OWNER IS A TENANT AT ITS CURRENT LOCATIONS, AND ANY DELAY IN COMPLETION OF THE WORK IS LIKELY TO PLACE OWNER IN HOLDOVER STATUS AS TO ITS EXISTING LEASES; AND 4) THE AMOUNT OF DAMAGE LANDLORD MAY SUFFER IN THE EVENT THAT CONTRACTOR FAILS TO TIMELY COMPLETE THE WORK IS SPECULATIVE AND MAY BE SUBJECT TO FACTORS THAT MAKE ACTUAL DAMAGES IMPOSSIBLE TO PROVE. AS SUCH, CONTRACTOR AGREES TO PAY TO OWNER LIQUIDATED DAMAGES IN THE AMOUNT OF ONE THOUSAND DOLLARS (\$1,000.00) PER DAY IN THE EVENT OF ANY DELAY IN SUBSTANTIAL COMPLETION OR FINAL COMPLETION OF THE WORK. THE FOREGOING AMOUNT IS AN ESTIMATE OF OWNER'S ACTUAL DAMAGES FROM ANY SUCH DELAY, AND CONTRACTOR CONSENTS TO ITS REASONABLENESS. NOTHING SET FORTH HEREIN SHALL PRECLUDE OWNER FROM SEEKING ACTUAL PROVABLE DAMAGES FOR DELAY IN EXCESS OF THE AFOREMENTIONED AMOUNT SHOULD THEY OCCUR.

## ***Certification of Document's Authenticity***

***AIA® Document D401™ – 2003***

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 14:06:45 ET on 03/28/2024 under Order No. 3104239930 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A101™ – 2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, other than those additions and deletions shown in the associated Additions and Deletions Report.

---

*(Signed)*

---

*(Title)*

---

*(Dated)*

1 DOCUMENT 006005 - GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

2 1.1 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

3 A. AIA Document A201, "General Conditions of the Contract for Construction," is hereby incorporated into the  
4 Procurement and Contracting Requirements by reference.

5 1. A copy of AIA Document A201, " General Conditions of the Contract for Construction", is bound in  
6 this Project Manual.

7 END OF DOCUMENT 006005



# AIA® Document A201® – 2017

## General Conditions of the Contract for Construction

### for the following PROJECT:

*(Name and location or address)*

Aston Township Municipal Complex  
3264 Concord Road  
Aston, PA 19014

### THE OWNER:

*(Name, legal status and address)*

Aston Township  
2 New Road  
Aston, PA 19014

### THE ARCHITECT:

*(Name, legal status and address)*

Bernardon LLC  
10 North High Street, Suite 310  
West Chester, PA 19380

### TABLE OF ARTICLES

1	GENERAL PROVISIONS
2	OWNER
3	CONTRACTOR
4	ARCHITECT
5	SUBCONTRACTORS
6	CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7	CHANGES IN THE WORK
8	TIME
9	PAYMENTS AND COMPLETION
10	PROTECTION OF PERSONS AND PROPERTY
11	INSURANCE AND BONDS
12	UNCOVERING AND CORRECTION OF WORK
13	MISCELLANEOUS PROVISIONS

### ADDITIONS AND DELETIONS:

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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**14      TERMINATION OR SUSPENSION OF THE CONTRACT**

**15      CLAIMS AND DISPUTES**



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**User Notes:**

(1248540792)

## INDEX

(Topics and numbers in bold are Section headings.)

### **Acceptance of Nonconforming Work**

9.6.6, 9.9.3, **12.3**

### **Acceptance of Work**

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3

### **Access to Work**

**3.16**, 6.2.1, 12.1

### **Accident Prevention**

10

### **Acts and Omissions**

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5, 10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

### **Addenda**

1.1.1

### **Additional Costs, Claims for**

3.7.4, 3.7.5, 10.3.2, 15.1.5

### **Additional Inspections and Testing**

9.4.2, 9.8.3, 12.2.1, **13.4**

### **Additional Time, Claims for**

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**

### **Administration of the Contract**

3.1.3, **4.2**, 9.4, 9.5

### **Advertisement or Invitation to Bid**

1.1.1

### **Aesthetic Effect**

4.2.13

### **Allowances**

**3.8**

### **Applications for Payment**

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10

### **Approvals**

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,

3.12.10.1, 4.2.7, 9.3.2, 13.4.1

### **Arbitration**

8.3.1, 15.3.2, **15.4**

## **ARCHITECT**

**4**

### **Architect, Definition of**

**4.1.1**

### **Architect, Extent of Authority**

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2, 9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1, 13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

### **Architect, Limitations of Authority and Responsibility**

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3, 4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2, 9.5.4, 9.6.4, 15.1.4, 15.2

### **Architect's Additional Services and Expenses**

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

### **Architect's Administration of the Contract**

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

### **Architect's Approvals**

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

### **Architect's Authority to Reject Work**

3.5, 4.2.6, 12.1.2, 12.2.1

### **Architect's Copyright**

1.1.7, 1.5

### **Architect's Decisions**

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1, 13.4.2, 15.2

### **Architect's Inspections**

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4

### **Architect's Instructions**

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

### **Architect's Interpretations**

4.2.11, 4.2.12

### **Architect's Project Representative**

4.2.10

### **Architect's Relationship with Contractor**

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16, 3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

### **Architect's Relationship with Subcontractors**

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3

### **Architect's Representations**

9.4.2, 9.5.1, 9.10.1

### **Architect's Site Visits**

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

### **Asbestos**

10.3.1

### **Attorneys' Fees**

3.18.1, 9.6.8, 9.10.2, 10.3.3

### **Award of Separate Contracts**

6.1.1, 6.1.2

### **Award of Subcontracts and Other Contracts for Portions of the Work**

**5.2**

### **Basic Definitions**

**1.1**

### **Bidding Requirements**

1.1.1

### **Binding Dispute Resolution**

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5, 15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

### **Bonds, Lien**

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

### **Bonds, Performance, and Payment**

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**

### **Building Information Models Use and Reliance**

**1.8**

### **Building Permit**

3.7.1

### **Capitalization**

**1.3**

### **Certificate of Substantial Completion**

9.8.3, 9.8.4, 9.8.5



## **Certificates for Payment**

4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4

Certificates of Inspection, Testing or Approval  
13.4.4

Certificates of Insurance  
9.10.2

## **Change Orders**

1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2

**Change Orders, Definition of**

### **7.2.1**

## **CHANGES IN THE WORK**

2.2.2, 3.11, 4.2.8, **7**, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5

**Claims, Definition of**

### **15.1.1**

Claims, Notice of  
1.6.2, 15.1.3

## **CLAIMS AND DISPUTES**

3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4  
Claims and Timely Assertion of Claims

### **15.4.1**

## **Claims for Additional Cost**

3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**

## **Claims for Additional Time**

3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**

## **Concealed or Unknown Conditions, Claims for**

**3.7.4**

Claims for Damages  
3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7

Claims Subject to Arbitration

### **15.4.1**

## **Cleaning Up**

### **3.15, 6.3**

Commencement of the Work, Conditions Relating to  
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**

**Commencement of the Work, Definition of**  
**8.1.2**

## **Communications**

### **3.9.1, 4.2.4**

Completion, Conditions Relating to  
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2

## **COMPLETION, PAYMENTS AND**

### **9**

Completion, Substantial

3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2

Compliance with Laws

2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3

Concealed or Unknown Conditions

3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract

1.1.1, 6.1.1, 6.1.4

Consent, Written

3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2

## **Consolidation or Joinder**

### **15.4.4**

## **CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

1.1.4, **6**

**Construction Change Directive, Definition of**  
**7.3.1**

## **Construction Change Directives**

1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, **7.3**, 9.3.1.1

Construction Schedules, Contractor's

3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

**Contingent Assignment of Subcontracts**  
**5.4, 14.2.2.2**

**Continuing Contract Performance**  
**15.1.4**

**Contract, Definition of**  
**1.1.2**

## **CONTRACT, TERMINATION OR SUSPENSION OF THE**

**5.4.1.1, 5.4.2, 11.5, 14**

Contract Administration

3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating to

3.7.1, 3.10, 5.2, 6.1

Contract Documents, Copies Furnished and Use of  
1.5.2, 2.3.6, 5.3

**Contract Documents, Definition of**

### **1.1.1**

## **Contract Sum**

2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, **9.1**, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5, 15.2.5**

**Contract Sum, Definition of**

### **9.1**

Contract Time

1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5

**Contract Time, Definition of**

### **8.1.1**

## **CONTRACTOR**

### **3**

Contractor, Definition of

### **3.1, 6.1.2**

**Contractor's Construction and Submittal Schedules**

**3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2**



Contractor's Employees  
2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3, 11.3, 14.1, 14.2.1.1

**Contractor's Liability Insurance**  
**11.1**  
Contractor's Relationship with Separate Contractors and Owner's Forces  
3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4  
Contractor's Relationship with Subcontractors  
1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7, 9.10.2, 11.2, 11.3, 11.4  
Contractor's Relationship with the Architect  
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2, 3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.4, 15.1.3, 15.2.1  
Contractor's Representations  
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2  
Contractor's Responsibility for Those Performing the Work  
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8  
Contractor's Review of Contract Documents  
3.2  
Contractor's Right to Stop the Work  
2.2.2, 9.7  
Contractor's Right to Terminate the Contract  
14.1  
Contractor's Submittals  
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2, 9.8.3, 9.9.1, 9.10.2, 9.10.3  
Contractor's Superintendent  
3.9, 10.2.6  
Contractor's Supervision and Construction Procedures  
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4  
Coordination and Correlation  
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1  
Copies Furnished of Drawings and Specifications  
1.5, 2.3.6, 3.11  
Copyrights  
1.5, **3.17**  
Correction of Work  
2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3, 15.1.3.1, 15.1.3.2, 15.2.1  
**Correlation and Intent of the Contract Documents**  
**1.2**  
**Cost, Definition of**  
**7.3.4**  
Costs  
2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3, 7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2, 12.1.2, 12.2.1, 12.2.4, 13.4, 14  
**Cutting and Patching**  
**3.14**, 6.2.5

Damage to Construction of Owner or Separate Contractors  
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4  
Damage to the Work  
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4  
Damages, Claims for  
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2, 11.3, 14.2.4, 15.1.7  
Damages for Delay  
6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2  
**Date of Commencement of the Work, Definition of**  
**8.1.2**  
**Date of Substantial Completion, Definition of**  
**8.1.3**  
**Day, Definition of**  
**8.1.4**  
Decisions of the Architect  
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2, 14.2.2, 14.2.4, 15.1, 15.2  
**Decisions to Withhold Certification**  
9.4.1, **9.5**, 9.7, 14.1.1.3  
Defective or Nonconforming Work, Acceptance, Rejection and Correction of  
2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3, 9.10.4, 12.2.1  
Definitions  
1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1, 6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1  
**Delays and Extensions of Time**  
**3.2**, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**, 10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5  
**Digital Data Use and Transmission**  
**1.7**  
Disputes  
6.3, 7.3.9, 15.1, 15.2  
**Documents and Samples at the Site**  
**3.11**  
**Drawings, Definition of**  
**1.1.5**  
Drawings and Specifications, Use and Ownership of  
3.11  
Effective Date of Insurance  
8.2.2  
**Emergencies**  
**10.4**, 14.1.1.2, **15.1.5**  
Employees, Contractor's  
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2, 10.3.3, 11.3, 14.1, 14.2.1.1  
Equipment, Labor, or Materials  
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2  
Execution and Progress of the Work  
1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1, 3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1, 9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4

Extensions of Time  
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2, 10.4, 14.3, 15.1.6, **15.2.5**

**Failure of Payment**  
9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Faulty Work  
(See Defective or Nonconforming Work)

**Final Completion and Final Payment**  
4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3

Financial Arrangements, Owner's  
2.2.1, 13.2.2, 14.1.1.4

**GENERAL PROVISIONS**

**1**

**Governing Law**

**13.1**

Guarantees (See Warranty)

**Hazardous Materials and Substances**  
10.2.4, **10.3**

Identification of Subcontractors and Suppliers  
5.2.1

**Indemnification**  
3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3

**Information and Services Required of the Owner**  
2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5, 9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

**Initial Decision**

**15.2**

**Initial Decision Maker, Definition of**  
1.1.8

Initial Decision Maker, Decisions  
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Initial Decision Maker, Extent of Authority  
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

**Injury or Damage to Person or Property**  
**10.2.8**, 10.4

Inspections  
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 12.2.1, 13.4

Instructions to Bidders  
1.1.1

Instructions to the Contractor  
3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2

**Instruments of Service, Definition of**  
**1.1.7**

Insurance  
6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5, **11**

Insurance, Notice of Cancellation or Expiration  
11.1.4, 11.2.3

**Insurance, Contractor's Liability**

**11.1**

Insurance, Effective Date of  
8.2.2, 14.4.2

**Insurance, Owner's Liability**

**11.2**

**Insurance, Property**  
**10.2.5**, 11.2, 11.4, 11.5

Insurance, Stored Materials  
9.3.2

**INSURANCE AND BONDS**

**11**

Insurance Companies, Consent to Partial Occupancy  
9.9.1

Insured loss, Adjustment and Settlement of  
11.5

Intent of the Contract Documents  
1.2.1, 4.2.7, 4.2.12, 4.2.13

**Interest**  
**13.5**

**Interpretation**  
1.1.8, 1.2.3, **1.4**, 4.1.1, 5.1, 6.1.2, 15.1.1

Interpretations, Written  
4.2.11, 4.2.12

Judgment on Final Award  
15.4.2

**Labor and Materials, Equipment**  
1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2

Labor Disputes  
8.3.1

Laws and Regulations  
1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8, 15.4

Liens  
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Limitations, Statutes of  
12.2.5, 15.1.2, 15.4.1.1

Limitations of Liability  
3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6, 4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3, 11.3, 12.2.5, 13.3.1

Limitations of Time  
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7, 5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15, 15.1.2, 15.1.3, 15.1.5

**Materials, Hazardous**  
**10.2.4**, **10.3**

Materials, Labor, Equipment and  
1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and Procedures of Construction  
3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien  
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

**Mediation**  
8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1, 15.4.1.1

**Minor Changes in the Work**  
1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**

## MISCELLANEOUS PROVISIONS

### 13

#### Modifications, Definition of

##### 1.1.1

#### Modifications to the Contract

1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2

#### Mutual Responsibility

### 6.2

#### Nonconforming Work, Acceptance of

9.6.6, 9.9.3, 12.3

Nonconforming Work, Rejection and Correction of  
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2

#### Notice

1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2, 2.2.3, 2.2.4, 2.5, 3.2.4, 3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4, 8.2.2, 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1, 13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5, 15.1.6, 15.4.1

#### Notice of Cancellation or Expiration of Insurance

11.1.4, 11.2.3

#### Notice of Claims

1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, 15.1.3, 15.1.5, 15.1.6, 15.2.8, 15.3.2, 15.4.1

#### Notice of Testing and Inspections

13.4.1, 13.4.2

#### Observations, Contractor's

3.2, 3.7.4

#### Occupancy

2.3.1, 9.6.6, 9.8

#### Orders, Written

1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1

## OWNER

### 2

#### Owner, Definition of

##### 2.1.1

#### Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

#### Owner, Information and Services Required of the

2.1.2, 2.2, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

#### Owner's Authority

1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7

#### Owner's Insurance

### 11.2

#### Owner's Relationship with Subcontractors

1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

#### Owner's Right to Carry Out the Work

2.5, 14.2.2

#### Owner's Right to Clean Up

### 6.3

#### Owner's Right to Perform Construction and to Award Separate Contracts

### 6.1

#### Owner's Right to Stop the Work

### 2.4

#### Owner's Right to Suspend the Work

### 14.3

#### Owner's Right to Terminate the Contract

14.2, 14.4

#### Ownership and Use of Drawings, Specifications and Other Instruments of Service

1.1.1, 1.1.6, 1.1.7, 1.5, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3

#### Partial Occupancy or Use

9.6.6, 9.9

#### Patching, Cutting and

3.14, 6.2.5

#### Patents

3.17

#### Payment, Applications for

4.2.5, 7.3.9, 9.2, 9.3, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3

#### Payment, Certificates for

4.2.5, 4.2.9, 9.3.3, 9.4, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4

#### Payment, Failure of

9.5.1.3, 9.7, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

#### Payment, Final

4.2.1, 4.2.9, 9.10, 12.3, 14.2.4, 14.4.3

#### Payment Bond, Performance Bond and

7.3.4.4, 9.6.7, 9.10.3, 11.1.2

#### Payments, Progress

9.3, 9.6, 9.8.5, 9.10.3, 14.2.3, 15.1.4

## PAYMENTS AND COMPLETION

### 9

#### Payments to Subcontractors

5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2

#### PCB

10.3.1

#### Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, 11.1.2

#### Permits, Fees, Notices and Compliance with Laws

2.3.1, 3.7, 3.13, 7.3.4.4, 10.2.2

## PERSONS AND PROPERTY, PROTECTION OF

### 10

#### Polychlorinated Biphenyl

10.3.1

#### Product Data, Definition of

### 3.12.2

#### Product Data and Samples, Shop Drawings

3.11, 3.12, 4.2.7

#### Progress and Completion

4.2.2, 8.2, 9.8, 9.9.1, 14.1.4, 15.1.4

#### Progress Payments

9.3, 9.6, 9.8.5, 9.10.3, 14.2.3, 15.1.4

**Project, Definition of**  
**1.1.4**  
**Project Representatives**  
 4.2.10  
**Property Insurance**  
 10.2.5, **11.2**  
**Proposal Requirements**  
 1.1.1  
**PROTECTION OF PERSONS AND PROPERTY**  
**10**  
**Regulations and Laws**  
 1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1,  
 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4  
**Rejection of Work**  
 4.2.6, 12.2.1  
**Releases and Waivers of Liens**  
 9.3.1, 9.10.2  
**Representations**  
 3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1  
**Representatives**  
 2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1  
**Responsibility for Those Performing the Work**  
 3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10  
**Retainage**  
 9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3  
**Review of Contract Documents and Field**  
**Conditions by Contractor**  
**3.2, 3.12.7, 6.1.3**  
**Review of Contractor's Submittals by Owner and**  
**Architect**  
 3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2  
**Review of Shop Drawings, Product Data and Samples**  
**by Contractor**  
 3.12  
**Rights and Remedies**  
 1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1,  
 6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2,  
 12.2.4, **13.3, 14, 15.4**  
**Royalties, Patents and Copyrights**  
**3.17**  
**Rules and Notices for Arbitration**  
 15.4.1  
**Safety of Persons and Property**  
**10.2, 10.4**  
**Safety Precautions and Programs**  
 3.3.1, 4.2.2, 4.2.7, 5.3, **10.1, 10.2, 10.4**  
**Samples, Definition of**  
**3.12.3**  
**Samples, Shop Drawings, Product Data and**  
**3.11, 3.12, 4.2.7**  
**Samples at the Site, Documents and**  
**3.11**  
**Schedule of Values**  
**9.2, 9.3.1**  
**Schedules, Construction**  
 3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

**Separate Contracts and Contractors**  
 1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2  
**Separate Contractors, Definition of**  
**6.1.1**  
**Shop Drawings, Definition of**  
**3.12.1**  
**Shop Drawings, Product Data and Samples**  
 3.11, **3.12, 4.2.7**  
**Site, Use of**  
**3.13, 6.1.1, 6.2.1**  
**Site Inspections**  
 3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4  
**Site Visits, Architect's**  
 3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4  
**Special Inspections and Testing**  
 4.2.6, 12.2.1, 13.4  
**Specifications, Definition of**  
**1.1.6**  
**Specifications**  
 1.1.1, **1.1.6, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14**  
**Statute of Limitations**  
 15.1.2, 15.4.1.1  
**Stopping the Work**  
 2.2.2, 2.4, 9.7, 10.3, 14.1  
**Stored Materials**  
 6.2.1, 9.3.2, 10.2.1.2, 10.2.4  
**Subcontractor, Definition of**  
**5.1.1**  
**SUBCONTRACTORS**  
**5**  
**Subcontractors, Work by**  
 1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2,  
 9.6.7  
**Subcontractual Relations**  
**5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1**  
**Submittals**  
 3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8,  
 9.9.1, 9.10.2, 9.10.3  
**Submittal Schedule**  
 3.10.2, 3.12.5, 4.2.7  
**Subrogation, Waivers of**  
**6.1.1, 11.3**  
**Substances, Hazardous**  
**10.3**  
**Substantial Completion**  
 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, **9.8, 9.9.1, 9.10.3, 12.2,**  
 15.1.2  
**Substantial Completion, Definition of**  
**9.8.1**  
**Substitution of Subcontractors**  
 5.2.3, 5.2.4  
**Substitution of Architect**  
 2.3.3  
**Substitutions of Materials**  
 3.4.2, 3.5, 7.3.8  
**Sub-subcontractor, Definition of**  
**5.1.2**

Subsurface Conditions

3.7.4

**Successors and Assigns**

**13.2**

**Superintendent**

3.9, 10.2.6

**Supervision and Construction Procedures**

1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3, 7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4

**Suppliers**

1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6, 9.10.5, 14.2.1

**Surety**

5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2, 15.2.7

**Surety, Consent of**

9.8.5, 9.10.2, 9.10.3

**Surveys**

1.1.7, 2.3.4

**Suspension by the Owner for Convenience**

**14.3**

**Suspension of the Work**

3.7.5, 5.4.2, 14.3

**Suspension or Termination of the Contract**

5.4.1.1, 14

**Taxes**

3.6, 3.8.2.1, 7.3.4.4

**Termination by the Contractor**

14.1, 15.1.7

**Termination by the Owner for Cause**

5.4.1.1, 14.2, 15.1.7

**Termination by the Owner for Convenience**

**14.4**

**Termination of the Architect**

2.3.3

**Termination of the Contractor Employment**

14.2.2

## **TERMINATION OR SUSPENSION OF THE CONTRACT**

**14**

**Tests and Inspections**

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 10.3.2, 12.2.1, 13.4

**TIME**

**8**

**Time, Delays and Extensions of**

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, 8.3, 9.5.1, 9.7, 10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5

**Time Limits**

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2, 5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2, 15.1.3, 15.4

**Time Limits on Claims**

3.7.4, 10.2.8, 15.1.2, 15.1.3

**Title to Work**

9.3.2, 9.3.3

## **UNCOVERING AND CORRECTION OF WORK**

**12**

**Uncovering of Work**

**12.1**

**Unforeseen Conditions, Concealed or Unknown**

3.7.4, 8.3.1, 10.3

**Unit Prices**

7.3.3.2, 9.1.2

**Use of Documents**

1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

**Use of Site**

3.13, 6.1.1, 6.2.1

**Values, Schedule of**

9.2, 9.3.1

**Waiver of Claims by the Architect**

13.3.2

**Waiver of Claims by the Contractor**

9.10.5, 13.3.2, 15.1.7

**Waiver of Claims by the Owner**

9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, 15.1.7

**Waiver of Consequential Damages**

14.2.4, 15.1.7

**Waiver of Liens**

9.3, 9.10.2, 9.10.4

**Waivers of Subrogation**

6.1.1, 11.3

**Warranty**

3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2, 15.1.2

**Weather Delays**

8.3, 15.1.6.2

**Work, Definition of**

**1.1.3**

**Written Consent**

1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3, 13.2, 13.3.2, 15.4.4.2

**Written Interpretations**

4.2.11, 4.2.12

**Written Orders**

1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1



## **ARTICLE 1 GENERAL PROVISIONS**

### **§ 1.1 Basic Definitions**

#### **§ 1.1.1 The Contract Documents**

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

#### **§ 1.1.2 The Contract**

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### **§ 1.1.3 The Work**

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

#### **§ 1.1.4 The Project**

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

#### **§ 1.1.5 The Drawings**

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

#### **§ 1.1.6 The Specifications**

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

#### **§ 1.1.7 Instruments of Service**

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

#### **§ 1.1.8 Initial Decision Maker**

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

### **§ 1.2 Correlation and Intent of the Contract Documents**

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

**§ 1.2.1.1** The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

**§ 1.2.2** Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

**§ 1.2.3** Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### **§ 1.3 Capitalization**

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

### **§ 1.4 Interpretation**

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### **§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service**

**§ 1.5.1** The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

**§ 1.5.2** The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

### **§ 1.6 Notice**

**§ 1.6.1** Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

**§ 1.6.2** Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

### **§ 1.7 Digital Data Use and Transmission**

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

### **§ 1.8 Building Information Models Use and Reliance**

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

## **ARTICLE 2 OWNER**

### **§ 2.1 General**

**§ 2.1.1** The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

**§ 2.1.2** The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

### **§ 2.2 Evidence of the Owner's Financial Arrangements**

**§ 2.2.1** Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

**§ 2.2.2** Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

**§ 2.2.3** After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

**§ 2.2.4** Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

### **§ 2.3 Information and Services Required of the Owner**

**§ 2.3.1** Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

**§ 2.3.2** The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.



§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

#### **§ 2.4 Owner's Right to Stop the Work**

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

#### **§ 2.5 Owner's Right to Carry Out the Work**

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

### **ARTICLE 3 CONTRACTOR**

#### **§ 3.1 General**

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

#### **§ 3.2 Review of Contract Documents and Field Conditions by Contractor**

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

**§ 3.2.2** Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

**§ 3.2.3** The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

**§ 3.2.4** If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

### **§ 3.3 Supervision and Construction Procedures**

**§ 3.3.1** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

**§ 3.3.2** The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

**§ 3.3.3** The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

### **§ 3.4 Labor and Materials**

**§ 3.4.1** Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

**§ 3.4.2** Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

### § 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

### § 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

### § 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

### § 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.



### **§ 3.8 Allowances**

**§ 3.8.1** The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

**§ 3.8.2** Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

**§ 3.8.3** Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### **§ 3.9 Superintendent**

**§ 3.9.1** The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

**§ 3.9.2** The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

**§ 3.9.3** The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

### **§ 3.10 Contractor's Construction and Submittal Schedules**

**§ 3.10.1** The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

**§ 3.10.2** The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

**§ 3.10.3** The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

### **§ 3.11 Documents and Samples at the Site**

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

**§ 3.12 Shop Drawings, Product Data and Samples**

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

**§ 3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

**§ 3.12.10.1** If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

**§ 3.12.10.2** If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

### **§ 3.13 Use of Site**

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

### **§ 3.14 Cutting and Patching**

**§ 3.14.1** The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

**§ 3.14.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

### **§ 3.15 Cleaning Up**

**§ 3.15.1** The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

**§ 3.15.2** If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

### **§ 3.16 Access to Work**

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

### **§ 3.17 Royalties, Patents and Copyrights**

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.



### **§ 3.18 Indemnification**

**§ 3.18.1** To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

**§ 3.18.2** In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

## **ARTICLE 4 ARCHITECT**

### **§ 4.1 General**

**§ 4.1.1** The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

**§ 4.1.2** Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

### **§ 4.2 Administration of the Contract**

**§ 4.2.1** The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

**§ 4.2.3** On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

### **§ 4.2.4 Communications**

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

**§ 4.2.5** Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

**§ 4.2.6** The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

**§ 4.2.7** The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

**§ 4.2.8** The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

**§ 4.2.9** The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

**§ 4.2.10** If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

**§ 4.2.11** The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

**§ 4.2.12** Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

**§ 4.2.13** The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

**§ 4.2.14** The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.



## ARTICLE 5 SUBCONTRACTORS

### § 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### § 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

### § 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

### § 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

### **§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts**

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

### **§ 6.2 Mutual Responsibility**

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### § 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

### § 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

### § 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:



- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

**§ 7.3.5** If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

**§ 7.3.6** Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

**§ 7.3.7** A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

**§ 7.3.8** The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

**§ 7.3.9** Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

**§ 7.3.10** When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

#### **§ 7.4 Minor Changes in the Work**

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

### **ARTICLE 8 TIME**

#### **§ 8.1 Definitions**

**§ 8.1.1** Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

**§ 8.1.2** The date of commencement of the Work is the date established in the Agreement.

**§ 8.1.3** The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

## **§ 8.2 Progress and Completion**

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

## **§ 8.3 Delays and Extensions of Time**

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## **ARTICLE 9 PAYMENTS AND COMPLETION**

### **§ 9.1 Contract Sum**

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

### **§ 9.2 Schedule of Values**

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

### **§ 9.3 Applications for Payment**

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

**§ 9.3.1.2** Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

**§ 9.3.2** Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

**§ 9.3.3** The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

#### **§ 9.4 Certificates for Payment**

**§ 9.4.1** The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

**§ 9.4.2** The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

#### **§ 9.5 Decisions to Withhold Certification**

**§ 9.5.1** The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;



- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

**§ 9.5.2** When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

**§ 9.5.3** When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

**§ 9.5.4** If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

## **§ 9.6 Progress Payments**

**§ 9.6.1** After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

**§ 9.6.2** The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

**§ 9.6.3** The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

**§ 9.6.4** The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

**§ 9.6.5** The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

**§ 9.6.6** A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

**§ 9.6.7** Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

**§ 9.6.8** Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

## **§ 9.7 Failure of Payment**

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

## **§ 9.8 Substantial Completion**

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

**§ 9.8.2** When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**§ 9.8.3** Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

**§ 9.8.4** When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

**§ 9.8.5** The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

## **§ 9.9 Partial Occupancy or Use**

**§ 9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

**§ 9.9.2** Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.



§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

### § 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

### § 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

**§ 10.2.2** The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

**§ 10.2.3** The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

**§ 10.2.4** When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

**§ 10.2.5** The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

**§ 10.2.6** The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

**§ 10.2.7** The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

**§ 10.2.8 Injury or Damage to Person or Property**

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

**§ 10.3 Hazardous Materials and Substances**

**§ 10.3.1** The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

**§ 10.3.2** Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

**§ 10.3.5** The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

**§ 10.3.6** If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

#### **§ 10.4 Emergencies**

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

### **ARTICLE 11 INSURANCE AND BONDS**

#### **§ 11.1 Contractor's Insurance and Bonds**

**§ 11.1.1** The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

**§ 11.1.2** The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

**§ 11.1.3** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

**§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act



or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

## **§ 11.2 Owner's Insurance**

**§ 11.2.1** The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

**§ 11.2.2 Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

**§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

## **§ 11.3 Waivers of Subrogation**

**§ 11.3.1** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

**§ 11.3.2** If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

## **§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance**

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

#### **§11.5 Adjustment and Settlement of Insured Loss**

**§ 11.5.1** A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

**§ 11.5.2** Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

### **ARTICLE 12 UNCOVERING AND CORRECTION OF WORK**

#### **§ 12.1 Uncovering of Work**

**§ 12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

#### **§ 12.2 Correction of Work**

##### **§ 12.2.1 Before Substantial Completion**

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

##### **§ 12.2.2 After Substantial Completion**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### § 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### § 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

### § 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

### § 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and



approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

**§ 13.4.2** If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

**§ 13.4.3** If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

**§ 13.4.4** Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

**§ 13.4.5** If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

**§ 13.4.6** Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

### **§ 13.5 Interest**

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

## **ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT**

### **§ 14.1 Termination by the Contractor**

**§ 14.1.1** The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

**§ 14.1.2** The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

**§ 14.1.3** If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

**§ 14.2 Termination by the Owner for Cause**

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

**§ 14.3 Suspension by the Owner for Convenience**

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

**§ 14.4 Termination by the Owner for Convenience**

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.



§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

## **ARTICLE 15 CLAIMS AND DISPUTES**

### **§ 15.1 Claims**

#### **§ 15.1.1 Definition**

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

#### **§ 15.1.2 Time Limits on Claims**

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

#### **§ 15.1.3 Notice of Claims**

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

#### **§ 15.1.4 Continuing Contract Performance**

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

#### **§ 15.1.5 Claims for Additional Cost**

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

#### **§ 15.1.6 Claims for Additional Time**

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

### **§ 15.1.7 Waiver of Claims for Consequential Damages**

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

### **§ 15.2 Initial Decision**

**§ 15.2.1** Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

**§ 15.2.2** The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

**§ 15.2.3** In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

**§ 15.2.4** If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

**§ 15.2.5** The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

**§ 15.2.6** Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

**§ 15.2.6.1** Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

### § 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

### § 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

**§ 15.4.4 Consolidation or Joinder**

**§ 15.4.4.1** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

**§ 15.4.4.2** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.



# **Additions and Deletions Report for**

## **AIA® Document A201® – 2017**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 14:10:24 ET on 03/28/2024.

### **PAGE 1**

Aston Township Municipal Complex  
3264 Concord Road  
Aston, PA 19014

...

Aston Township  
2 New Road  
Aston, PA 19014

...

Bernardon LLC  
10 North High Street, Suite 310  
West Chester, PA 19380

## **Certification of Document's Authenticity**

**AIA® Document D401™ – 2003**

I, \_\_\_\_\_, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 14:10:24 ET on 03/28/2024 under Order No. 3104239930 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 2017, General Conditions of the Contract for Construction, other than those additions and deletions shown in the associated Additions and Deletions Report.

\_\_\_\_\_  
(Signed)

\_\_\_\_\_  
(Title)

\_\_\_\_\_  
(Dated)

DOCUMENT 006010 – SUPPLEMENTAL CONDITIONS

The General Conditions governing this work are the “General Conditions of the Contract for Construction”, AIA Document A201-2017, Electronic Format, a copy of which is bound in this Project Manual.

The following Supplements modify, change, delete from, or add to the General Conditions noted above.

Where any Article of the General Conditions is modified or any Paragraph, Subparagraph, or Clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph, or Clause shall remain in effect.

In addition to the General Conditions, these Supplementary Conditions will apply to the contract as a whole, and to each and every sub-contract, and to all persons supplying any materials or labor entering into this building directly or indirectly.

Article 1, Paragraph 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS, , add the following Subparagraph 1.2.1.2:

1.2.1.2 In the event of omissions from the Drawings or Specifications, or conflicts or discrepancies between the Contract Documents, or should any error appear in the various instruments furnished or in the work accomplished by other contractors affecting the work included, it will be the duty of the Contractor to notify the Architect and obtain the necessary information, and see that the work is carried out in compliance therewith, and that any damage or defect in the work caused thereby is properly corrected.

Any work required by either the Drawing or Specifications and not by the other shall be performed as if denoted in both. Should any work be required which is not also denoted in the Specifications or on the Drawings because of an obvious omission, but which is, nevertheless, necessary for the proper performance of the project, such work shall be performed as fully as if it were described and delineated.

Article 2, Paragraph 2.2 EVIDENCE OF THE OWNER’S FINANCIAL ARRANGEMENTS.

Delete Subparagraph 2.2 and all subparagraphs.

Article 3, Paragraph 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR, Subparagraph 3.2.2:

In the first sentence, delete the words “each portion of” and “that portion of” (twice).

Article 3, Paragraph 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES, Subparagraph 3.3.2. Change the end of the sentence to read:

“... Subcontractors, including Suppliers and their agents and employees.”

Article 3, Paragraph 3.4 LABOR AND MATERIALS. Add the following Subparagraphs:

3.4.4 All materials delivered to the premises which are to form a part of the work are to be considered the property of the Owner and must not be removed without the Owner’s consent. Material not incorporated in the work shall become the Contractor’s property and are to be removed from the Project Site at or prior to Substantial Completion.

3.4.5 No Contractor, nor Subcontractor, shall subcontract, sublet, sell, transfer, assign, purchase work or materials from an organization other than his/her own, or otherwise dispose of the contract or contracts or any portion thereof, or of his/her right, title, or interest therein, without written permission from the Owner. In case such permission is given, the Contractor, or Subcontractor, will be permitted to

subcontract or sublet a portion thereof but will perform with his/her own organization, work amounting to not less than ten percent of the total contract bid price, exclusive of General Condition Items, Overhead, and Profit.

Article 3, Paragraph 3.5 WARRANTY. Change the third sentence of Subparagraph 3.5.1 to read as follows:

"The Contractor's warranty excludes remedy for damage or defect caused by Owner's abuse, modifications not executed by the Contractor, improper or insufficient maintenance or improper operation by the Owner, or normal wear and tear and normal usage."

Article 3, Paragraph 3.5 WARRANTY. Add the following Subparagraph:

3.5.3 The General Warranty for materials and workmanship for all systems, components and operations is one (1) year commencing on the date of Substantial Completion, unless the system, component, or material is determined not to be complete and is so noted on the Certificate of Substantial Completion. The General Warranty for systems, components, or materials not found to be complete on the original date of Substantial Completion is one (1) year commencing on the date the system, component, or material is determined to be complete, and shall be so indicated in a separate Certificate of Substantial Completion. Defects appearing during this period will be made good by the Contractor at his expense upon demand by the Owner.

In addition to the General Warranty, there are other warranties required for certain items and for different periods of time than the one (1) year as above, and are particularly so stated in that part of the specifications referring to them. The said warranties will commence at the same time as the General Warranty, as noted on the Certificate of Substantial Completion.

If the Contractor fails to remedy any failure, defect or damage within a reasonable time after receipt of notice, the Owner will have the right to replace, repair, or otherwise remedy the failure, defect or damage at the Contractor's expense.

Article 3, Paragraph 3.6 TAXES. Add the following Subparagraph:

3.6.1 No sales tax or use taxes shall be paid on construction activities or items which the Commonwealth of Pennsylvania's Department of Revenue has determined to be tax exempt (Sales and Use Tax Regulations) relating to Municipal and Non-Profit Construction.

Article 4, Paragraph 4.2 ADMINISTRATION OF THE CONTRACT, Subparagraph 4.2.2. Add the following clause:

4.2.2.1 Understanding that the General Construction Contractor is responsible to coordinate the activities and work of all Prime Contractors and sub-contractors and understanding that the Project will be completed on a multiple prime contract basis, in the event that any questions or disputes regarding sequence of work is brought to the attention of the Owner or the Architect, the Architect will endeavor to direct sequencing and resolve any such problems regarding sequencing in a professional and competent manner. Resolution of these questions or disputes shall not result in additional charges to the Owner or Architect, from Prime Contractors or sub-contractors.

Article 5, Paragraph 5.1 DEFINITIONS. Add the following Subparagraph 5.1.3:

5.1.3 A Supplier is a person or entity who has a direct or indirect contract with the Contractor, Subcontractor or Sub-subcontractor to furnish materials or equipment for the Work. The term "Supplier" is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Supplier or an authorized representative of the Supplier.



Article 5, Paragraph 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK. Subparagraph 5.2.1. Add the following clause:

5.2.1.1 Upon approval of Subcontractors, the Contractor shall award his Subcontracts as soon as possible after the signing of his own contract and see that all materials, his own and those of his Subcontractors, are promptly ordered so that the work will not be delayed by failure of materials to arrive on time.

Article 7, Paragraph 7.2 CHANGE ORDERS, add the following Subparagraph 7.2.2:

7.2.2 In Clause 7.2.1 above, the allowance for overhead and profit combined that is to be included in the amount of the Contract Sum adjustment to the Owner, shall be based on the schedule contained in Clauses 7.3.11.1 through 7.3.11.5, and shall be indicated as separate line items on the Contractor's Cost Breakdown.

Article 7, Paragraph 7.3 CONSTRUCTION CHANGE DIRECTIVES, Clause 7.3.3.1. Add the following to the end of the sentence:

“and with an allowance for overhead and profit in accordance with the schedule set forth in Subparagraph 7.3.11 below.”

Article 7, Paragraph 7.3 CONSTRUCTION CHANGE DIRECTIVES, Paragraph 7.3.4. Change the first sentence as follows:

Delete the words “an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount” and substitute “an allowance for overhead and profit in accordance with the schedule set forth in Subparagraph 7.3.11 and related clauses below.”

Article 7, Paragraph 7.3 CONSTRUCTION CHANGE DIRECTIVES. Add the following Subparagraph 7.3.11:

7.3.11 In Clause 7.3.3.1 and Subparagraph 7.3.4, the allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the following schedule:

- .1 For the Contractor, for any Work performed by the Contractor's own forces, fifteen percent (15%).
- .2 For the Contractor, for work performed by his Subcontractor or material supplier, five percent (5%) of the amount due the Subcontractor.
- .3 For each Subcontractor or Sub-subcontractor involved, for any Work performed by that Contractor's own forces, fifteen percent (15%) of the cost.
- .4 For each Subcontractor, for Work performed by his Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractors.
- .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Clauses 7.3.4.1 through 7.3.4.5.

Article 7, Paragraph 7.3 CONSTRUCTION CHANGE DIRECTIVES. Add the following Subparagraph 7.3.12:

7.3.12 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed above; labor costs shall be actual costs (wages and benefits), not standardized billing rates. Where major cost items are subcontracts, they shall be itemized also. In no case will a change involving over \$300.00 be approved without such itemization.

Article 8, Paragraph 8.3 DELAYS AND EXTENSIONS OF TIME, Subparagraph 8.3.1. Add the following clause:

8.3.1.1 Contractor will submit written itemization to the Owner within ten (10) days of any alleged act or neglect by Architect or Owner, which itemization will set forth such act or neglect of Architect or Owner, and any alleged delay resulting therefrom.

Article 9, Paragraph 9.3 APPLICATIONS FOR PAYMENT, Subparagraph 9.3.1. In the first line, change:

“ten days” to “thirty days.”

Article 9, Paragraph 9.3 APPLICATIONS FOR PAYMENT. Delete Subparagraph 9.3.2 in its entirety and substitute the following Subparagraph and Clauses:

9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made only on account of materials and equipment incorporated in the Work or delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, and upon individual application in a form approved by the Architect, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or of the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner’s title to such materials and equipment or otherwise protect the Owner’s interest, and shall include applicable insurance, storage, security, and transportation to the site for such materials and equipment stored off the site.

In addition to the above, payment may be requested by the Contractor for the following specific items which shall be identified and included as separate line items in the Schedule of Values.

- .1 “Permits and Approval Fees”, to the extent that costs are directly attributable to the Project.
- .2 “Performance Bond and Labor and Material Payment Bond”, if furnished.
- .3 “General Conditions”, which shall be the category covering all miscellaneous items such as the cost of Contractor’s insurance, Contractor’s overhead, project administration including the preparation and processing of required submittals, mobilization, temporary facilities, project layout, and on-site supervision, etc.

Cost assigned to General Conditions in the Schedule of Values shall be no greater than five percent (5%) of the Contract Sum.”

Article 9, Paragraph 9.6 PROGRESS PAYMENTS. Add the following Subparagraph 9.6.9:

9.6.9 Until the Project reaches 50% completion, the Owner will retain 10% of the amount due the Contractor.

At 50% completion, the Contractor may make Application for a Reduction of Retainage of up to one-half of the amount retained. Upon certification by the Architect, the amount retained will be reduced by the amount certified, but in no case will retainage be less than 5% of the Contract amount.

In the absence of sufficient reason, within 20 days of the receipt of payment by the Contractor, the Contractor shall pay all Subcontractors with which it has contracted their earned share of the payment the Contractor has received.

After the Contract is 50% complete, the retainage will be 5% of the value of completed work based on monthly progress payment requests.

All as subject to compliance with provisions Commonwealth of Pennsylvania Procurement Code (1998 P.L.358, No. 57) Title 62, Part II, Chapter 39, Section 3921.

Article 9, Paragraph 9.7 FAILURE OF PAYMENT. Change the first sentence to read as follows:

“If the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by arbitration, then the Contractor may, upon seven additional days’ notice to the Owner and Architect, stop the work until payment of the amount owing has been received.”

Article 9, Paragraph 9.8 SUBSTANTIAL COMPLETION. In the second line of Subparagraph 9.8.1, change the words “. . .the Owner can occupy or utilize the work . . .” to “. . .the Owner can occupy and utilize the work . . .” and add the following Clause 9.8.1.1:

9.8.1.1 Substantial Completion cannot be achieved prior to the issuance of the Certificate of Occupancy

Article 9, Paragraph 9.8 SUBSTANTIAL COMPLETION. Delete Subparagraph 9.8.2 and substitute the following:

9.8.2 When the Contractor considers that the work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall submit a written request to the Architect for the Architect to make an inspection. The Contractor shall prepare a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Article 9, Paragraph 9.8 SUBSTANTIAL COMPLETION. Change the first line of Subparagraph 9.8.3 to read:

“Within 10 days of receipt of the Contractor’s request, the Architect will make. . .”

Article 9, Paragraph 9.8 SUBSTANTIAL COMPLETION. Change the second sentence of Subparagraph 9.8.5 to read:

“Upon acceptance of the Certificate of Substantial Completion, Certification by the Architect of the Contractor’s Final Application for Payment, and consent of surety, the Owner shall make final payment applying to such work or designated portion thereof, within 45 days.

Article 9, Paragraph 9.8 SUBSTANTIAL COMPLETION. Add the following Sub-paragraph 9.8.6:

9.8.6 Substantial/final payment amounts will be reduced by one and one-half times the amount required to complete any then-remaining uncompleted minor items, as certified and listed in the Certificate of Completion by the Architect. Final payment will be paid upon completion of the items on the certified list.

Article 10, Paragraph 10.3 HAZARDOUS MATERIALS AND SUBSTANCES. Add Sub-paragraph 10.3.7 as follows:

10.3.7 Materials supplied or containing components that may be considered hazardous shall be provided with Material Safety Data Sheets (MSDS) for those products. Material Safety Data Sheets must be provided directly to the Owner along with the shipping slips that include the product.

Note: Any Product should be considered hazardous if it has a “Warning” or “Caution” on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions, or in any foreseeable emergency situation.

Article 10, Paragraph 10.3 HAZARDOUS MATERIALS. Add Sub-paragraph 10.3.8 as follows:

10.3.8 The Contract shall certify to the Owner that materials incorporated into the work are free of all asbestos. The certification may be in the form of Material Safety Data Sheet (MSDS) provided by the product manufacturer:

Article 12, Paragraph 12.3 ACCEPTANCE OF NONCONFORMING WORK. Change paragraph 12.3 to the following:

12.3 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case, the Owner will have the right to deduct such sum, or sums, of money from the amount of the Contract Sum

1 as he determines to be appropriate and equitable. Such adjustment shall be effected whether or not  
2 final payment has been made.

3 Article 15, Paragraph 15.1.4 CONTINUING CONTRACT PERFORMANCE, Subparagraph 15.1.4.3. Add the  
4 following clause:

5 Prime Contractors and sub-contractors shall ensure that contract work not in dispute will not be  
6 hindered by any unresolved dispute.

7 END OF DOCUMENT 006010

## 1 DOCUMENT 006011 – INSURANCE

2 The General Conditions governing this work are the “General Conditions of the Contract for Construction”, AIA  
3 Document A201-2017, Electronic Format, a copy of which is bound in this Project Manual.

4 The following Supplements modify, change, delete from, or add to the General Conditions noted above.

5 Article 11, Paragraph 11.1 CONTRACTOR’S LIABILITY INSURANCE. Add the following clause 11.1.1.9:

6 11.1.1.9 Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis,  
7 including:

- 8 .1 Premises Operations (including X-C/U coverages).
- 9 .2 Independent Contractors’ Protective.
- 10 .3 Products and Completed Operations.
- 11 .4 Personal Injury Liability with Employment Exclusion deleted.
- 12 .5 Contractual, including specified provisions for the Contractor’s obligation under Paragraph 3.18.
- 13 .6 Owned, non-owned, and hired motor vehicles.
- 14 .7 Broad Form Property Damage, including Completed Operations.
- 15 .8 Owner’s and Contractor’s Protective Liability.
- 16 .9 Umbrella Excess Liability.

17 Article 11, Paragraph 11.1 CONTRACTOR’S LIABILITY INSURANCE. Add the following clause 11.1.1.10:

18 11.1.1.10 If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-  
19 made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the  
20 policy or applicable extended reporting period shall be no earlier than the termination date of coverages  
21 required to be maintained after final payment, certified in accordance with Sub-paragraph 9.10.2.

22 Article 11, Paragraph 11.1 CONTRACTOR’S LIABILITY INSURANCE. Add to Sub-paragraph 11.1.2 the  
23 following clause 11.1.2.1:

24 11.1.2.1 The Insurance required under Sub-paragraph 11.1.1. shall be written for not less than the following  
25 limits, or greater if required by law:

26 1. Worker’s Compensation:

- 27 (a) State: Statutory
- 28 (b) Applicable Federal: Statutory
- 29 (c) Employer’s Liability: \$500,000 Per Accident
- 30 \$500,000 Disease, Policy Limit
- 31 \$500,000 Disease, Each Employee

32 2. Comprehensive or Commercial General Liability (including Premises – Operations;  
33 Independent Contractors’ Protective; Products and Completed Operations; Broad Form Property  
34 Damage):

- 35 (a) Bodily Injury and Property Damage Combined:
  - 36 \$ 1,000,000 Each Occurrence
  - 37 \$ 2,000,000 Aggregate
- 38 (b) Products and Completed Operations to be maintained for one year after final payment:
  - 39 \$ 1,000,000 Aggregate
- 40 (c) Property Damage Liability Insurance shall provide X, C and U coverage.
- 41 (d) Broad Form Property Damage Coverage shall include Completed Operations.
- 42

## 3. Contractual Liability:

## (a) Bodily Injury and Property Damage Combined:

\$ 1,000,000 Each Occurrence

\$ 2,000,000 Aggregate

## 4. Personal Injury with Employment Exclusion deleted:

## 5. Business Auto Liability (including owned, non-owned and hired vehicles):

(a) Bodily Injury: \$ 1,000,000 Each Person

\$ 1,000,000 Each Occurrence

(b) Property Damage: \$ 1,000,000 Each Occurrence

(c) In lieu of (a) and (b) above, Bodily Injury and Property Combined:

\$ 1,000,000 Each Occurrence

## 6. If the General Liability coverages are provided by a Commercial Liability Policy, the:

(a) General Aggregate shall be not less than \$2,000,000 and it shall apply, in total, to this project only.

(b) Fire Damage Limit shall be not less than \$50,000 on any one fire.

(c) Medical expense limit shall be not less than \$5,000 on any one person.

## 7. Umbrella Excess Liability: \$5,000,000 per occurrence/annual aggregate over primary insurance, including Commercial General Liability, Business Auto Liability, and Employer's Liability.

Article 11, Paragraph 11.1 CONTRACTOR'S LIABILITY INSURANCE. Add to Sub-paragraph 11.1.3 the following clauses 11.1.3.1 and 11.1.3.2:

11.1.3.1 If this insurance is written on the Comprehensive General Liability policy form, ACORD Form 25S will be acceptable. If the ACORD form is utilized, AIA Document G715 shall also be completed in full and submitted.

11.1.3.2 The Certificate of Insurance shall reference that Endorsement CG2503 "Amendment – Aggregate Limits of Insurance (Per Project)" is a part of the Contractor's Commercial General Liability Policy.

Article 11 Paragraph 11.1 CONTRACTOR'S LIABILITY INSURANCE. Add the following sub-paragraph 11.1.4:

11.1.4 The Contractor shall purchase insurance from a company having an A.M. Best & Company rating of "A" or better.

Article 11, Paragraph 11.1 CONTRACTOR'S LIABILITY INSURANCE. Add the following sub-paragraph 11.1.5:

11.1.5 The Contractor shall make Aston Township jointly and severally as Additional Insureds. He shall provide an endorsement from his insurance carrier (in addition to notation on Certificate required above) to the Owner within two weeks after execution of the Agreement stating that this subparagraph has been complied with. The endorsement shall obligate the insurance carrier to give Aston Township thirty (30) days notice of cancellation of the insurance coverage(s).

Article 11, Paragraph 11.3 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE:

Delete Sub-paragraph 11.3.3.

Article 11, Paragraph 11.4 PROPERTY INSURANCE. Delete clause 11.4.1.4 and substitute the following:

1        11.4.1.4 The Contractor shall provide insurance coverage for portions of the work stored off the site after  
2                written approval of the Owner at the value established in the approval and also for portions of the work  
3                in transit.

4        Article 11, Paragraph 11.4 PROPERTY INSURANCE. Change the first line of Sub-paragraph 11.4.1 to read:

5        11.4.1    The Contractor shall purchase and maintain in a company. . .

6        Article 11, Paragraph 11.4 PROPERTY INSURANCE. Add the following Sub-paragraph 11.4.11:

7        11.4.11 The Contractor's owned or rented construction machinery, tools and similar construction equipment,  
8                which will be used in connection with the construction services required for the Work, but which will  
9                not become a permanent part thereof, are not covered by the insurance provided for in this Paragraph  
10              11.4; insurance coverage for such items is the Contractor's responsibility.

11        END OF DOCUMENT 006011

DOCUMENT 006100 – PARTIAL WAIVER OF LIEN TO DATE

**PARTIAL WAIVER OF LIEN TO DATE**

**TO WHOM IT MAY CONCERN:**

WHEREAS the undersigned has been contracted by ASTON TOWNSHIP

To furnish \_\_\_\_\_ the Aston Township Muncipal Complex

For the premises known as \_\_\_\_\_ Aston Township Municipal Complex \_\_\_\_\_, (hereinafter “the Project”).

Of which \_\_\_\_\_ Aston Township \_\_\_\_\_ is the Owner.

In consideration of the sum of \_\_\_\_\_ dollars (\$ \_\_\_\_\_) paid on account of labor and materials supplied through the \_\_\_\_\_ day of \_\_\_\_\_, 2024, the receipt of which is hereby acknowledged, and in consideration of other good and valuable benefits accruing to the undersigned, the undersigned hereby execute(s) this Partial Waiver of Lien to Date in favor of each and every party owning the property improved, in favor of <NAME OF PRIME CONTRACTOR>, and in favor of each and every party making a loan on said real estate, as improved, and his or its successors and assigns, and in doing so the undersigned hereby waive(s) and release(s) any and all lien or claim of, or right to lien that the undersigned, either have or has as of the \_\_\_\_\_ day of \_\_\_\_\_, 2024 to a lien upon the Project’s land, improvements, material, fixtures, apparatus or machinery, by virtue of the laws of the state(s) wherein said land, material, fixtures, apparatus or machinery is situate, or any amendments of said laws; and do(es) further warrant that the undersigned has not or have not and will not assign the undersigned(s)’ claims for payments, nor right to perfect a lien against said property, and that the undersigned have the right to execute this waiver and release thereof.

**Note:** All waivers must be for the full amount paid. If waiver is for a corporation, corporate name should be used, corporate seal affixed and title of the officer signing waiver should be set fourth; if waiver is for a partnership, the partnership name should be used, partners should sign and note partner designation.

**COMPANY:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

\_\_\_\_\_  
**SIGNATURE**

\_\_\_\_\_  
**DATE**

END OF DOCUMENT 006100



1 SECTION 011000 - SUMMARY

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes the following:

- 8 1. Project Information  
9 2. Work covered by the Contract Documents.  
10 3. Type of the Contract.  
11 4. Work by Owner.  
12 5. Owner-furnished products.  
13 6. Access to Site.  
14 7. Coordination with Occupants.  
15 8. Work restrictions.  
16 9. Specification formats and conventions.

- 17 B. Related Sections include the following:

- 18 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing  
19 temporary use of Owner's facilities.

20 1.3 PROJECT INFORMATION

- 21 A. Project Information: Aston Township Municipal Complex

- 22 1. Project Location: 3264 Concord Road, Aston Township, Delaware County, Pennsylvania.

- 23 B. Owner: Aston Township – 2 New Road, Aston, PA 19014.

- 24 C. Architect: Bernardon, LLC – 10 North High Street, Suite 310, West Chester, PA 19380.

25 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- 26 A. The Work consists of the following:

- 27 1. The Work includes construction of a 21,735 square foot, two-story Municipal Complex to house  
28 the Township Administration and Police Department. The Work includes sitework including new  
29 bituminous parking lots, concrete sidewalks and curbs, stormwater management structures,  
30 erosion and sedimentation control, and landscaping.

- 31 a. All sitework is shown on sheets prepared by G.D. Houtman & Son, Inc.

2. The Work includes, but is not limited to concrete footings and foundation walls, cast-in-place concrete, concrete unit masonry, structural steel, cold-formed metal framing systems, metal stair, interior architectural millwork, thermal insulation, EPDM roofing, standing seam metal roofing, aluminum storefront and curtainwall systems, glazing, hollow metal doors and frames, flush wood doors, sectional overhead doors, mirrors, bathroom accessories, fire extinguishers and cabinets, lockers, evidence storage lockers, high-density storage systems, hydraulic elevator, and signage including building-mounted signage and free-standing signage near street intersection. Interior finishes include, but are not limited to, gypsum board on metal framing systems, flush wood paneling, acoustical panel ceiling systems, resilient and ceramic tile, epoxy terrazzo flooring, carpeting, and paint finishes. Heating, Ventilation, and Air-Conditioning systems; Plumbing, Fire-protection systems; Fire alarm and detection systems; Information Technology systems, including cabling, equipment, phone, internet, and WiFi systems; Audio/visual systems, including equipment, cabling and terminal devices; Security camera and door alarm; Electrical power and lighting systems are also included in the construction. All construction is as described in the Contract Documents.

#### 1.5 TYPE OF CONTRACT

- A. Project will be constructed under multiple prime contracts as follows:

1. General Construction Contract.
2. Plumbing Contract.
3. Mechanical Contract.
4. Electrical Contract.
5. Elevator Contract.

#### 1.6 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
1. Furniture, fixtures, and equipment.
- C. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.
1. Installation of all furniture, including shelving, racks, work benches, and desks, window treatment such as curtains and blinds, and office equipment such as copiers and printers, exercise equipment, and vending machines.

#### 1.7 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.
- B. Owner-Furnished Products:
1. Kitchen appliances.
  2. High-density storage shelving.

3. Furniture.

#### 1.8 ACCESS TO SITE

A. Contractor shall have limited use of Project site for construction operations by the Contract limits and as indicated by requirements of this Section.

1. Limited parking for contractors and subcontractors will be available on site in areas designated for "Construction parking only". Contractors and subcontractors may park off-site; however, they shall be responsible for parking fees associated with parking off-site.

B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

#### 1.9 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

#### 1.10 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed between the hours of 7:00 AM to 6:00 PM, Monday through Friday, unless otherwise restricted/permitted by the Township of Marple, and as authorized by the Owner.

1. Extended work days, hours, shifts, or weekend work may be allowed with the approval of the Owner, and, if required, the Township of Marple. Additional costs associated with extended work days, hours, shifts, or weekend work shall be borne by the Contractor, including any additional costs incurred by the Owner and Architect. NO additional costs are to be charged to the Owner.

2. Notify Architect not less than two days in advance of proposed utility interruptions.
3. Obtain Architect's written permission before proceeding with utility interruptions.
4. Hours for Utility Shutdowns: During normal working hours and as approved by the utility.

B. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor air intakes.

## 1.11 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 49-division format and CSI "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

## SECTION 011200 - MULTIPLE CONTRACT SUMMARY

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.
- B. Specific requirements for Work of each contract are also indicated in individual Specification Sections and on Drawings.
- C. Related Requirements:
1. Section 011000 "Summary" for the Work covered by the Contract Documents, restrictions on use of Project site, coordination with occupants, and work restrictions.
  2. Section 013100 "Project Management and Coordination" for general coordination requirements.

## 1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

## 1.4 COORDINATION

- A. Multiple Prime Contractor Coordinator shall be responsible for coordination between the General Construction Contract, Plumbing Contract, Mechanical Contract, Electrical Contract, and Elevator Contract.
1. General Construction (GC) Contractor shall act as and assume all responsibilities of the Project Coordinator.
- B. Mechanical/Plumbing/Electrical (MPE) Coordinator, who shall be subordinate to Project Coordinator, shall be responsible for coordination between the Mechanical Contract, Plumbing Contract, and Electrical Contracts (MC/PC/EC Contracts).
1. Mechanical Contractor (MC) shall act as and assume all responsibilities of the MPE Coordinator.

## 1.5 MULTIPLE PRIME CONTRACTOR COORDINATOR

A. Multiple Prime Contractor Coordinator: Full-time Project Coordinator shall be experienced in administration and supervision of building construction, including site construction activities, plumbing, mechanical, electrical work. Multiple Prime Contractor Coordinator shall perform multiple-prime contractor coordination activities for the multiple contracts, including, but not limited to, the following:

1. Provide overall coordination of the Work.
2. Coordinate shared access to workspaces.
3. Coordinate product selections for compatibility.
4. Provide overall coordination of temporary facilities and controls.
5. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.
6. Coordinate construction and operations of the Work with work performed by each Contract and Owner's construction forces.
7. Prepare coordination drawings in collaboration with each contractor to coordinate work by more than one contract.
8. Coordinate sequencing and scheduling of the Work. Include the following:
  - a. Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.
  - b. Prepare combined Contractors' Construction Schedule for entire Project. Base schedule on preliminary construction schedule. Secure time commitments for performing critical construction activities from contractors. Show activities of each contract on a separate sheet. Prepare a simplified summary sheet indicating combined construction activities of contracts. The project coordinator is responsible for everything listed in spec section 013200 Construction progress documentation including providing the overall construction schedule as coordinated with all Prime Contractors, providing monthly schedule updates to the constructions schedule, and providing recovery schedules as needed amongst the other items required in 013200. General Contractor to provide the Construction schedule to the Owner and Architect, refer to 011000 Summary for Work Milestones and Time of Completion.
  - c. Distribute copies of schedules to Architect, Owner, and separate Contractors.
  - d. Prepare & Maintain a Request for Information (RFI) Log per Division 01 Section 013100 Paragraph 1.4
  - e. Prepare & Maintain a Testing & Inspections Log per Division 01 Section 014000 Paragraph 3.1
9. Provide quality-assurance and quality-control services specified in Division 01 Section "Quality Control Requirements."
10. Provide project and conference meeting memos when required by Architect or Construction Manager and as specified in Division 01 Section "Project Management and Coordination".
11. Schedule and conduct progress meetings as specified in Division 01 Section "Project Meetings."
12. Schedule, conduct and record Coordination Meetings as specified in Division 01 Section "Project Meetings."
13. Provide photographic documentation.
14. Provide quality-assurance and quality-control services specified in Section 014000 "Quality Requirements."
15. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.
16. Locate existing permanent benchmarks, control points, and similar reference points, and establish permanent benchmarks on Project site.
17. Provide field surveys of in-progress construction and site work.
18. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.

19. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.
20. Coordinate cutting and patching.
21. Coordinate protection of the Work.
22. Coordinate the installation of concealed blocking or reinforcement and supports for work of all primes.
23. Coordinate provision of openings required by MC, PC, and EC Contractors with concrete and masonry work.
24. Coordinate the sequence of work to the benefit of the project schedule.
25. Coordinate cutting and patching.
26. Coordinate protection of the Work.
27. Coordinate the selection and installation of firestopping products with the separate prime Contractors.
28. Coordinate completion of interrelated punch list items.
29. Coordinate preparation of Project Record Documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.
30. Print and submit Record Documents if installations by more than one contractor are indicated on the same Contract Drawing or Shop Drawing.
31. Collect record Specification Sections from prime contractors, collate Sections into numeric order, and submit complete set.
32. Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

#### 1.6 MECHANICAL, PLUMBING, ELECTRICAL (MPE) COORDINATOR

- A. MPE Coordinator: Full-time Mechanical/Plumbing/Electrical Coordinator shall be experienced in coordination of mechanical, plumbing, and electrical construction (as well as all other subcontracts including but not limited to Fire Protection, Fire Alarm, ATC Controls), including coordination of type of operations required for this Project.

1. Coordination activities of MPE Coordinator include, but are not limited to, the following:
  - a. Preparation of coordination drawings of ceiling cavities and mechanical rooms demonstrating the spatial relationship and necessary clearances within the available space above ceilings and within rooms for mechanical, plumbing and fire protection, electrical power and lighting systems and structural systems. Comply with the requirements for coordination drawings as specified in the Division 01 Section "Coordination."
  - b. Schedule and sequence mechanical, plumbing/FP and electrical activities.
  - c. Coordinate sharing access to workspaces by mechanical, plumbing/FP and electrical Contractors.
  - d. Coordinate integration of mechanical, plumbing/FP and electrical work into limited spaces.
  - e. Coordinate protection of mechanical, plumbing/FP and electrical Contractors' work.
  - f. Coordinate cutting and patching for mechanical, plumbing/FP and electrical work.
  - g. Prepare mechanical, plumbing/FP and electrical Coordination Drawings.
  - h. Coordinate tests and inspections for mechanical, plumbing/FP and electrical work.
  - i. Coordinate mechanical, plumbing/FP and electrical temporary services and facilities.

## 1.7 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Unless the Agreement contains a more specific description of the Work, names and terminology on Drawings and in Specifications determine which Contract includes a specific element of Project.

1. To the extent that the work of all of the Contracts represents a complete and integrated whole, each Prime Contractor shall become thoroughly familiar with all of the construction documents. Work of a particular Contract shall be substantially located on the documents referenced below, but such references do not relieve each Prime Contractor for responsibility to provide work in compliance with requirements of all of the documents as follows:

a. Information contained on any construction document shall be enforceable on each Contractor as indicated on drawings, by reference to Contractor designations (GC, PC, MC, and EC).

b. Dimensional information on the Architectural drawings that relates to the work of a particular Contract shall be the responsibility of that Contractor to install the item where located.

1) In the absence of specific dimensional information on the Architectural plans for exposed items provided by the Mechanical, Plumbing, Electrical and Elevator Contracts, consult Architect for decisional requirements before installing exposed item.

c. In case of conflicts, assignment of responsibilities shall be at the interpretation of the Architect or Owner Representative.

2. Unless otherwise indicated, the Work described in this Section for each Prime Contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Contract Documents.

3. Local custom and trade-union jurisdictional settlements do not control the scope of the Work of each Contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, affected Prime Contractors shall negotiate a reasonable settlement as labor disputes cannot interrupt or delay the project.

4. Excavation and Trenches for the Work of each Prime Contract shall be provided by each Contract for its own Work except as noted otherwise. Comply with Division 31 Section "Earth Moving" and all trench details on the contract documents for excavation and trenches.

5. Concrete for the Work shall be provided by each Contract for its own Work, except as noted otherwise. Comply with Section 033000 - Cast-in-Place Concrete for requirements.

6. Cutting and Patching: Provided by each Prime Contract for its own Work, unless otherwise noted. Comply with Division 01 specifications for this work.

a. Contractor performing an operation out of sequence and thereby forcing another Contractor unexpectedly cut and patch construction already in place shall be held responsible for the cutting and patching the second Contractor is forced to do.

7. Support work as specified in Section 055000 - Metal Fabrications to connect work of each Contract to the structural system shall be provided by each Contract for its own work.

a. Support work shall include reinforcements welded within steel joists, as indicated on the structural drawings, for point loads on steel joists.

8. Through-penetration firestopping and fireblocking for the Work of each Prime Contract shall be provided by each Prime Contract for its own Work using products from the manufacturer as selected by the Multiple Prime Contract Coordinator. Comply with the Division 07 requirements for firestopping and fireblocking.



9. Protection for the Work of each Prime Contractor shall be provided by each Prime Contract for its own work. Comply with Division 01 Section 015000 - Temporary Facilities and Controls and individual specification sections for protection requirements.
10. Concealed sealants for the Work of each Contract shall be provided by each Contract for its own work. Comply with Section 079200 - Joint Sealants for requirements.
11. Access doors and frames or panels for permanent access to work of each Contract shall be furnished by each Contract for its own work. Installation of the access panel shall be by the General Contractor.
12. Refer to General Conditions for scheduling requirements.
13. Project closeout requirements.

B. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Section 015000 - Temporary Facilities and Controls each Contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, and costs associated with each facility.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Generators for powering welders. Each Contractor must provide a portable generator for welding operations. Welding may not be connected to temporary or permanent power service
4. Generators for equipment requiring 3-phase power. This shall also include temporary power for 3-phase permanent equipment that must be tested before connection to and /or availability of permanent power supply.
5. Its own field office, complete with necessary furniture, utilities, and telephone service via wireless provider. Mechanical, Plumbing, Electrical, and Elevator Prime Contractors are allowed only one large trailer on site (40-50ft C box) or two small trailers.
6. Its own storage and fabrication sheds.
7. Temporary enclosures for its own construction activities.
8. All hoisting facilities for its own construction activities. Contractor may provide its own hoisting facilities or may arrange with the General Contractor by separate agreement to provide hoisting facilities.
9. Progress cleaning of its own areas on a daily basis.
10. Secure lockup of its own tools, materials, and equipment.
11. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
12. Protection of its own work including finishes.

C. Temporary Electric Power Service, Heating, Cooling, and Ventilation: The Electrical Construction Contract is responsible for temporary electric power service, including temporary connection from the existing switchgear to project offices located in the staging area, to existing building and the new building. The General Construction Contract is responsible for temporary heating, cooling, and ventilation, including temporary connections, until new unit is fully operational. The building HVAC systems (whether existing or new) shall not be operated for the purpose of temporary heating, cooling, or ventilation).

D. Temporary Distribution and Lighting: Electrical Contractor is responsible for temporary distribution and lighting systems.

E. Temporary Water Service: Owner's water is available for use by each Contractor. The Plumbing Contractor shall provide a hose bib inside of Mechanical room in the Lower Level and at exterior adjacent to parking lot. Plumbing Contractor to maintain water to these two sources throughout the entire project

F. Temporary Sanitary Facilities:

1. General Construction Contractor is responsible for sanitary facilities, including toilets, and wash facilities, including use, rental, and maintenance charges for all work area under his responsibility. All Contractors shall be responsible for their own drinking water.

G. Temporary Power Generators: All contractors to provide temporary power generators as needed until temporary power is available on site.

H. Use Charges: Comply with the following:

1. Sewer Service: Include the cost for sewer service use by all parties engaged in construction activities at Project site in the General Construction Contract.
2. Water Service: Include the cost for water service, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site in the General Construction Contract.
3. Electric Power Service: Include the cost for electric power service, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site in the General Construction Contract.

#### 1.8 DESCRIPTION OF CONTRACTS

A. The work of this project shall be performed under five (5) Prime Contracts as defined in this Section.

B. The following is a list of the Prime Contracts to be bid for this project:

Contract 1	General Construction (GC) Contract
Contract 2	Plumbing Construction (PC) Contract
Contract 3	Mechanical Construction (MC) Contract
Contract 4	Electrical Construction (EC) Contract
Contract 5	Elevator Construction Contract

C. The General Conditions and Division 01 - General Requirements shall apply to all Prime Contracts and Subcontracts for this Project. Each Prime Contract package description is to include all Work in accordance with the Contract Documents, except Work covered by other Prime Contract package descriptions. Collectively, these Prime Construction Contracts include all materials, labor, supervision, transportation, tools, equipment and services for the Project as shown or implied on the drawings and specified herein, or as may be required or necessary for a complete and satisfactory job.

D. If there is a conflict on a specific item with regards to assignment of work to a specific Contractor between the Contract Documents and the Prime Contract package description as stated herein, the Prime Contract package description will govern; however, if an item is covered in the Contract Documents, but not reiterated in the Prime Contract package description, the Bidder will be responsible for that item of work.

If an item is covered in two or more contract package descriptions, each Contractor shall include the item at the time of bid. After Contract award, a credit will be solicited for work in question.

E. Each Prime Contractor shall supervise his Work, using his best skills and attention. Each Prime Contractor shall be solely responsible for construction means, methods, techniques, sequences, dimensions and procedures and/or coordinating all portions of their Work, with all Work to be performed under separate contracts. Refer to the General Conditions Article 6 on work by Separate Contractors or by Owner.

- 1 F. All items of work listed under the Prime Contract package descriptions shall be provided by the Prime  
2 Contractor unless specifically noted as furnished or installed only.
- 3 G. All Prime Contractors shall maintain site conduct in accordance with the rules and procedures  
4 specified under the General Conditions.
- 5 H. All Prime Contractors shall maintain, contribute to and coordinate the schedule as required in the  
6 specification Section 013200 - Construction Progress Documentation.
- 7 I. Contract Documents include all drawings, specifications, contract descriptions, etc. for the work of  
8 the Project. Each Prime Contractor shall review all Documents in their entirety.
- 9 J. The Owner shall pay all utility tap-in fees for the permanent structure. All other fees, including  
10 utility connection fees for temporary facilities and all other permits are the responsibility of the  
11 appropriate Prime Contractors. The Building Permit Fee and the Township's Contractor Registration  
12 Fee are waived for this project. The Owner will provide builder's risk insurance.
- 13 K. The Installing Prime Contractors will provide testing services for all work as indicated in the  
14 technical specifications and in Section 014000 - Quality Requirements unless testing services are  
15 specifically noted as being provided by the Owner.
- 16 L. Each Prime Contractor shall be responsible to return all laydown, storage and work areas to their  
17 original condition except areas designated on the site utilization plan, which shall be the responsibility  
18 of the General Contractor. Confirmation of completion of this requirement shall be necessary prior to  
19 release of final payment.
- 20 M. Multiple trips to the site will be required to complete this project.
- 21 N. The following items are to be included in each Prime Contractor's Scope of Work:
- 22 1. Coordinate all work with other Prime Contractors.
- 23 2. Submit shop drawings, samples, schedules, data, manuals, as-built drawings, etc., required by  
24 the Contract Documents. Update, on a weekly basis, a record set of drawings to be  
25 maintained in the General Contractor's field office and made available for view at any time.
- 26 3. Observe and comply with at all times all Federal and State laws and regulations, and Local  
27 bylaws, ordinances and regulations in any manner affecting the conduct of the work or applying  
28 to employees on the project, as well as all safety precautions and orders or decrees which have  
29 been promulgated or enacted, or which may be promulgated or enacted, by legal bodies or  
30 tribunals having authority or jurisdiction over the work, materials, equipment, employees,  
31 such observance and compliance shall be solely and without qualification the responsibility of  
32 this Trades Contractor without reliance on superintendence or direction by the Owner or their  
33 Representative. The duty of enforcement of all of said laws, ordinances, regulations, orders  
34 or decrees lies with the body of agency promulgating them, not with the Owner or their  
35 Representatives.
- 36 4. Perform all work in accordance with the project schedule as described in Section 013200 –  
37 Construction Progress Documentation.
- 38 5. The General Contractor shall provide all engineering and layout for his work. In addition,  
39 the General Contractor shall provide and maintain throughout the project all building  
40 corners and column centerlines. The General Contractor shall provide floor control lines for  
41 each floor consisting of at least two perpendicular control lines per area and finish floor  
42 elevations. The General Contractor will provide layout for all walls and partitions. Each  
43 Trade Contractor shall be responsible for all other survey, engineering, layout, etc. required  
44 to execute their work. Each Trades Contractor, at his own expense is to provide all stakes,  
45 templates and labor required in laying out their work and is responsible for proper execution  
46 of the work to the lines and grades shown on the drawings or as indicated by the  
47 Architect/Engineer.

6. Provide all scaffolding, hoisting, shoring, barricades, ramps, etc., as necessary to perform the work of this contract.
7. Provide safety and protection of persons and property per OSHA, Local and State requirements. Provide maintenance of all safety precautions throughout the work of this Contract. Each Contractor is to return the safety cables to an OSHA approved condition without slack. Provide protection at floor and roof penetrations not shown on the drawings but required for work of this Contract. Provide all safety signage required by OSHA for the work of this Contract. Furnish Company Safety Plan, Hazard Communication Plan, MSDS information and other OSHA required documents to the "Multiple Prime Contractor Coordinator" prior to the start of work.
8. All contractor's personal working on or visiting the project site while construction activities are underway are required to wear safety glasses and hard hats at all times. Appropriate work shoes and clothing should be worn by all construction personal. The wearing of shorts or sleeveless shirts is not permitted. Clothing with offensive or politically incorrect wording / illustrations is not permitted.
9. Promptly address the recommendations made by the "Multiple Prime Contractor Coordinator" for jobsite safety.
10. If the applicable Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any work to specifically be tested, inspected, or approved by someone other than this Trades Contractor, the Contractor will give the Owner and their Representative timely notice of readiness. The Contractor will then furnish the Owner the required certificates of inspection, testing or approval.
11. Inspection, tests, or approvals by the Owner or their Representative shall not relieve this Trades Contractor from his obligation to perform the work in accordance with the requirements of the Contract Documents.
12. Provide all fees, Federal, State and Local taxes, special permits, inspections, etc. as required to perform the work of this Contract unless item is specifically identified as being provided by the Owner.
13. All submittals, shop drawings and product samples must be received no later than the Summary of Work Milestones and time of completion. Those submittals for critical schedule activities must be submitted and approved in time to make required deliveries. Contractors are responsible to make material deliveries to accomplish phase completions.
14. No guns, illegal drugs, tobacco products or alcoholic beverages will be allowed on this project. The Township may require any individual employed on engaged in the project, either directly or indirectly, to submit to drug, and/or alcohol testing, on the basis of reasonable suspicion or if an individual has been involved in an accident. Random drug and/or alcohol testing is strongly encouraged. All testing shall be paid by the Prime Contractors. Any individual who refuses to cooperate with or submit for testing or who test positive for alcohol or drugs shall be excluded from the job site at the direction of the Township.
15. The Owner and their Representatives will at all times have access to the work. In addition, authorized representatives and agents of any participating State, County or Local Municipal representative shall be permitted to inspect all work, materials, and other relevant data and records. This Trades Contractor will provide proper facilities for such access and observation of the work and also for any inspection or testing thereof.
16. The General Contractor shall provide for all temporary enclosures of building openings as required to maintain the schedule of the project. Should any Contractor have materials that are delayed on the project, which in turn delays the work of other Contractors, that Contractor shall be required to provide and/or maintain the temporary enclosures required to enclose the missing portions of that Contractor's Work.
17. Each Contractor shall provide holes in structural steel as required for the installation of their work with the approval of the Architect and Engineer. The structural reinforcing must be in accordance with the requirements of Structural Steel specification section.
18. Each Contractor shall provide sealants in accordance with Joint Sealant specification Section 079200 – Joint Sealants in any and all conditions where materials installed by the Contractor abut dissimilar materials (vertical and horizontal joints). Each Contractor is also responsible for sealing penetrations required for the scope of that trade.

19. All Contractors are responsible to clean their construction vehicle's wheels with the intent of keeping all mud off paved surfaces.
20. Each Prime Contractor is responsible for general clean-up and trash removal resulting from the work or employees of that contract. The General Contractor shall provide construction dumpster(s) as required for the purpose of trash removal for all Prime Contractors. Removal of demolition debris from site will be by the Contractor performing the demolition. Hazardous materials shall not be placed in the dumpster, but should be removed from site by Prime Contractor responsible for material. The General Contractor will also periodically organize a project clean up by all Contractors. Those Contractors on site shall provide labor to assist in this cleanup on a weekly basis. The General Contractor shall also provide a laborer a minimum of 16 hours a week to broom sweep the project's interior floor areas with approved sweeping compound to control dust through the duration of the project. General Contractor shall provide a separate line item on the schedule of values for this laborer to broom sweep these areas. Each Prime Contractor shall provide a line item on their initial schedule of values for ongoing project clean-up activities.
21. All Contractors are responsible to provide dust, toxic fume and noise control for their own work.
22. Cutting and Patching:
- a. Exposed finished materials, structural elements, watertight assemblies, HVAC, plumbing, and electrical equipment and systems.
- 1) Newly Installed Materials: A Contractor, requiring the cutting of openings in new work shall have such openings cut and patched by the trade which installed the work and such cutting and patching shall be at the expense of the Contractor, requiring the opening, unless specified otherwise.
- 2) Existing Materials: A Contractor requiring the cutting of openings in existing materials shall have such openings cut and patched by a Contractor specializing in that trade and the cost shall be at the expense of the Contractor requiring the opening.
- 3) Approval to do such cutting and patching shall be received from the architect prior to proceeding with the work and shall include installation of such reinforcement of the work as the Architect may direct.
- b. Other locations: Cutting and sealing of penetrations in other locations including firestopping shall be by the Contractor requiring the cutting of such openings.
- c. All blocking, bracing, reinforcement or structural enhancement required due to cutting and patching shall be provided at no additional cost to the Owner. All patching work shall match adjacent existing work unless otherwise noted.
23. Provide firesafing and firestopping at all locations that are required to maintain a fire rating at floor and wall penetrations as a result of work of each prime contract. All new and/or existing penetrations at walls or ceilings related to a prime Contractor's scope of work shall be firestopped by that Contractor as per the specifications.
24. Provide Steel and Aluminum product certifications as required under the Steel Products Procurement and Trade Practice Acts otherwise known collectively as the "Buy American" requirements of all Public Works Construction Contracts funded in part by the State of Pennsylvania.
25. Elevator Contractor will be responsible for the cost of up to and including two Labor and Industry elevator inspections. Any cost associated with additional inspections beyond the second inspection will be equally distributed to the parties that were responsible for the previous failure.
26. COORDINATION DRAWINGS: Coordination drawings among the HVAC, Plumbing, Fire Protection, Electrical and ceiling subcontractors are required with the lead role assigned to the HVAC Contractor. The Mechanical Contractor shall prepare 1/4 inch per foot scale CAD drawings with ductwork and piping layout for review by the other Prime Contractors and ceiling subcontractor. The other Contractors shall then prepare and provide CAD additions/modifications representing their work to the Mechanical Contractor, who will then prepare final layout and coordination drawings illustrating work by all Trades on one set of coordination drawings for the project as a part of his Contract price. The Mechanical Contractor shall conduct coordination

meetings with all Trade Contractors to discuss and resolve interference problems. Once each Prime Contractor has initialed with approval the coordination drawings, the Mechanical Contractor shall submit the coordination drawings to the Multiple Prime Contractor Coordinator for review. The other Prime Contractors should finalize their shop drawings in accordance with the coordination drawings and submit to the Multiple Prime Contractor Coordinator.

a. Schedule: The Mechanical Contractor shall prepare and distribute ductwork and piping drawings within 25 days after start of construction. The other Prime Contractors shall then prepare and distribute to the Mechanical Contractor their CAD input within 15 days. Final coordination drawings to be completed and distributed by the Mechanical Contractor for the first phase of construction within 55 days after start of construction.

27. Visit site prior to submitting bid and thoroughly examine the site for existing conditions that may need to be modified or demolished to provide the Work of this contract. Each Prime Contractor is to include the cost of those modifications or demolition cost within their base bid proposal. No claim for additional work will be permitted for modifications to existing conditions or demolition of existing items that are required to install new work of this contract that are apparent and should have been discovered during the prebid walkthrough.

#### 1.9 CONTRACT 1 - GENERAL CONSTRUCTION CONTRACT

A. Work of the General Construction Contract shall include the responsibilities of the Multiple Prime Contractor Coordinator.

B. Work of the General Construction Contract shall include all labor, materials, equipment, and services necessary for the complete construction of all Work shown on the General Information (G-series) Drawings, Civil (C-series) Drawings, Structural (S-series) Drawings, Architectural (A-series) Drawings, and described in Divisions 00, 01 through 13, and 31 through 33 of the Specifications, and may include portions other Divisions included in the Project Manual. Work also includes Division 14 – Conveying Systems requirements provided the Alternate GC-02 is incorporated in the General Construction Contract. (See also Responsibility Matrix in PART 3 – EXECUTION):

C. Work of the General Construction Contract includes, but is not limited to, the following:

1. Remaining work not identified as work under other contracts.
2. Site preparation, including clearing, and earthwork.
3. Site utility work including plumbing and mechanical, excluding site electric and site lighting.
4. Site improvements including: All asphalt paving, concrete curbing, concrete walkways, site development, site walls, fencing, and coordination of installation of motorized cantilever gate system by Electrical Contractor.
5. Sediment and erosion control including assumption of Erosion and Sedimentation Pollution Control permit and responsibilities thereof as co-permittee.
6. Poured concrete retaining walls.
7. Site storm water management system including roof drainage conductors, related earthwork and appurtenances starting from a point five feet beyond building.
8. Site stairs and railings.
9. Water meter pit for fire service.
10. Line stripping and landscaping.
11. Provide field surveys of as-built site improvement work in accordance with township requirements. Provide certification that work is located in accordance with the drawings. Confirm the building steel structure upon completion is plumb and level via a licensed surveyor
12. Foundations, including footings, foundation walls and elevator pit.
13. Below-grade building construction, including excavation, backfill, and waterproofing/dampproofing.
14. Construction of building envelope.
15. Interior construction, including partitions, doors, interior glazed openings, and fittings.

16. Fire-protection specialties.
17. Stairs, including railings and finishes.
18. Interior finishes, finish carpentry, casework, interior specialties, and floor and ceiling finishes.
19. Coordination of all work associated with Division 14 - Conveying Systems. Work shall include all requirements of Division 14 - Conveying Systems provided the Alternate GC-02 is incorporated in the Contract.
20. Miscellaneous items, including painting of exposed structural, mechanical, plumbing, and electrical work.
21. Obtain all final sign offs by authorities having jurisdiction including obtaining final Certificate of Occupancy.
22. Remove, abandon, fill existing piping no longer in use including storm water and sanitary piping.
23. Install all access panels required and provided by other Contractors. See 012750 Unit Prices and Quantity Allowances for the quantity of access panels to be installed.
24. Provide final cleaning of the building on all the interior and exterior facades.
25. Work must be complete, operational and tested to meet the requirements of state and local codes.
26. Installation of roof curbs provided by HVAC contractor. GC to supply and install all wood blocking for all roof top equipment curbs including but not limited to RTU's, exhaust fans, etc. Application includes existing roofs and roof of the new addition.
27. Install all sleeves provided by the Contractors in any walls, floors or roof structures. If Contractors do not provide sleeves in a timely manner per the scheduled activities, each Contractor will be responsible to neatly cut/core and make their own penetrations as well as patch as required to make installation complete.
28. Coordinate a loading location for all Contractors to use. Location may be a removed door or window opening. Location must be coordinated and agreed to by all Contractors by September 1, 2023.
29. GC is responsible, on behalf of the Owner, for providing the physical markings of all existing utilities including those on site as indicated on the drawings or that may be identified in the field. The locations shown on the drawings are approximate. The General Contractor shall include in his proposal the cost for hand-dug test holes, or other means, to ascertain the precise position of such underground facilities on the site owned by the Owner. This verification should be performed for any utilities to be relocated, removed, modified or that may otherwise interfere with planned work. The utilities in the public right of way will be identified and marked by the appropriate facility owner as per the requirements of the PA One Call Act as amended. Physical layout is to be performed in full compliance with the PA One Call PA Act 287 of 1974 as amended by Act 18 of 1996.

D. Temporary facilities and controls in the General Construction Contract include, but are not limited to, the following:

1. Temporary facilities and controls that are not otherwise specifically assigned to other Contracts.
2. Temporary roads, paved areas, staging, and stoned areas.
3. Unpiped sewers and drainage, including drainage ditches, dry wells, stabilization ponds, and containers.
4. Storm water control. Including temporary plastic roof drains to grade toward the construction lay down area, to be installed once the roof is installed until the permanent drains are installed.
5. Unpiped temporary toilet fixtures, wash facilities, and drinking water facilities, including disposable supplies.
6. Excavation support and protection, unless required solely for the Work of another contract.
7. Special or unusual hoisting requirements for construction activities, including hoisting loads in excess of 2 tons, hoisting material or equipment into spaces below grade, and hoisting requirements outside building enclosure.
8. Project identification and temporary signs.
9. General waste disposal facilities.
10. Temporary stairs.
11. Temporary fire-protection facilities.
12. Barricades, warning signs, and lights.



13. Security enclosure and lockup.
14. Environmental protection.

#### 1.10 CONTRACT 2 - PLUMBING CONTRACT

- A. Work of the Plumbing Contract shall include all labor, material, equipment and services necessary for the complete construction of all plumbing, drainage, fire protection, and Work of other piped systems shown on the General Information (G-series) Drawings, the MPEFP Cover Sheet, Plumbing (P-series) series Drawings, and described in Divisions 00, 01, 21, and 22 of the Specifications and may include other Divisions where noted. Include all plumbing connections to domestic water, sanitary waste, natural gas, and other piped plumbing systems for fixtures and devices associated with other Contracts, as well as close coordination with all other Contractors. Include all Fire-suppression systems including special fire-suppression systems that may including Clean-agent extinguishing systems.

The Plumbing Contract includes, but is not limited to, the following (see also Responsibility Matrix in PART 3 – EXECUTION):

1. Piped sewerage and drainage.
2. Piped gas service.
3. Piped water service.
4. Piped temporary toilet fixtures, wash facilities, and drinking water facilities.
5. Plumbing connections to temporary facilities and controls furnished by the General Construction Contract.
6. Plumbing connections to equipment furnished by the General Construction Contract, Mechanical Contract, and Electrical Contract.
7. Concrete equipment bases (pads) required by Plumbing work.
8. Hoisting required for contract work.
9. Provide Operation and Maintenance instruction manuals and specified training to the Owner including video taping of sessions.
10. Provide layout for the General Contractor indicating all openings in the new floor and roof decks that have dimensions larger than 10". Openings with dimensions smaller than 10" shall be provided by the Plumbing Contractor, who shall also provide support steel at these openings as required for installation by the General Contractor. All other framing, lintels, miscellaneous supports, etc., required but not specifically shown on the Drawings shall be by this Contractor. Plumbing Contractor should refer to the structural plans for lintel sizes.
11. Provide protection of structure, finishes, and landscaping from damage resulting from the Work of the Contract. Repair any damage promptly to the satisfaction of the Owner.
12. Provide painting for "touch up" required to restore "factory finished" equipment and material to its original condition.
13. Provide all plumbing Work including sanitary sewer and vent piping, domestic water piping and equipment, pipe insulation, water heater, roof and floor drains, plumbing fixtures, trim accessories, supports, anchorage, etc. unless shown or specified by others.
14. Provide all sprinkler work including sprinkler piping, heads, flow and taper switches, trim, accessories, supports unless shown or specified by others, anchorage, etc., as shown and/or specified.
15. Provide color-coding and identification of valves and lines as indicated.
16. Provide cleaning, disinfecting and testing of lines and equipment, and final inspection.
17. Provide wall sleeves, flashing, pipe hangers, supports, blocking, etc., as required for installation of fixtures and equipment.
18. Provide all insulation required for the scope of this Contract.
19. Provide all cutting, patching, excavation, bedding, backfill, etc., as necessary to install the Work of this Contract.
20. Provide any housekeeping and equipment pads required for equipment (interior or exterior) that are required for the work of this Contract, but not shown on Architectural, Civil, or Structural

- Drawings. General Contractor is to provide all housekeeping and equipment pads shown on Architectural, Civil, and Structural Drawings.
21. Furnish any embeds required to be cast in concrete or masonry to the appropriate Prime Contractor that would not be considered part of the building structure or any wall assembly but required as a result of this contract.
  22. Provide any miscellaneous structural framing and decking as required to ensure a complete installation of items that are a part of this Contract.
  23. Provide concrete at all services crossing under or near foundations that require excavated area to be filled with concrete.
  24. Coordinate with the General Contractor installation of piping installed inside masonry units, include providing any temporary supports that are necessary.
  25. Provide fireblocking/firestopping at all locations that are required to maintain a fire rating at floor and wall penetrations required as a result of the Work of this Contract.
  26. Furnish any access panels, which are required for, access to the Work by this Contract. Coordinate opening requirements with the General Contractor. Provide floor access boxes as specified.
  27. Provide final cleaning of all fixtures.
  28. Review and coordinate with General Contractor's millwork/casework subcontractors to furnish all sinks, sink outlets, faucets, bubblers, overflows, plugs, strainers, fittings, etc., as shown or specified. Plumbing Contractor will be responsible for installation and final connections of these items. Plumbing Contractor shall furnish and install all stops, and other fittings not listed above for casework equipment, as specified in plumbing sections and shall make all final connections. General Contractor will provide all accessories, as specified. Plumbing Contractor to make final connections of service fittings furnished by General Contractor.
  29. Coordinate tie in of sprinkler system to fire alarm system with Electrical Contractor. Provide flow and tamper switches for connection to fire alarm system.
  30. Electrical starters for Plumbing Equipment shall be provided under the Plumbing Contract. Disconnect furnished and installed by Electrical Contractor.
  31. Work must be complete, operational and tested to meet the requirements of state and local codes.
  32. Provide a temporary hose bibb for use by the GC and others as needed.
  33. Coordinate all roof penetrations with the General Contractor for both the new roof area of the addition and the existing roof area.
  34. Prior to tie-in to existing building systems, all piping should be tested and Plumbing Contractor shall provide test reports to the Owner's Construction Manager for record.
  35. Verification of the quality of any "existing to remain" piping, equipment, or appurtenances. Any defects, leaks, etc. are to be repaired as necessary.

#### 1.11 CONTRACT 3 - MECHANICAL CONTRACT

- A. Work of the Mechanical Contract shall include the responsibilities of the MPE Coordinator.
- B. Work of the Mechanical Contract shall include all labor, material, equipment, and services necessary for the complete construction of all heating, ventilation, air conditioning, and Work of other systems shown on the General Information (G-series) Drawings, MPEFP Cover Sheet, Mechanical (M-series) Drawings, and described in Divisions 00, 01 and 23 of the Specifications and may include other Divisions where noted. Include all mechanical connections to equipment furnished by the General Construction Contract, Plumbing Contract, and Electrical Contract. Include close coordination with all other Contractors.

The Mechanical Contract includes, but is not limited to, the following (see also Responsibility Matrix in PART 3 – EXECUTION):

1. Building automation system, including all wiring, software, controllers, switches, programming, graphics, and integration with owner's ethernet.
2. All Certified Mechanical Testing, Adjusting and Balancing.
3. General exhaust systems including associated power ventilators.
4. HVAC systems and equipment.

5. Vibration isolation.
6. Piping and duct insulation.
7. Ductwork shop drawings and coordination drawings
8. Roof curbs and all required blocking. Mechanical Contractor shall furnish curbs as required for all roof-mounted equipment to General Contractor. Wood blocking at roof openings to be by General Contractor. Coordinate blocking locations and requirements with General Contractor.
9. Mechanical connections to equipment furnished by the General Construction Contract Plumbing Contract and Electrical Contract.
10. Concrete equipment bases (pads) required by Mechanical Work.
11. Hoisting and rigging required for contract work.
12. Provide Operation and Maintenance instruction manuals and specified training to the Owner including video taping of sessions.
13. Provide layout for the General Contractor indicating all openings in the new floor and roof decks that have dimensions larger than 10". Openings with dimensions smaller than 10" shall be provided by the Mechanical Contractor, who shall also provide support steel at these openings as required for installation by the General Contractor. All other framing, lintels, miscellaneous supports, etc., required but not specifically shown on the Drawings shall be by this Contractor. Mechanical Contractor should refer to the structural plans for lintel sizes.
14. Provide protection of structure, finishes, and landscaping from damage resulting from the Work of the Contract. Repair any damage promptly to the satisfaction of the Owner.
15. Provide painting for "touch up" required to restore "factory finished" equipment and material to its original condition.
16. Install ductwork in accordance with the latest recommendations of ASHRAE and SMACNA.
17. Provide testing and cleaning of distribution systems and equipment and final inspection.
18. Coordinate connections of equipment, dampers, etc. as required to the fire alarm system with the Electrical Contractor.
19. Provide identification of equipment, valves, piping and ductwork as required.
20. Provide all cutting, patching, excavation, bedding, backfill, etc., as necessary to install the Work of this Contract.
21. Provide any housekeeping and equipment pads required for equipment (interior or exterior) that are required for the work of this Contract, but not shown on Architectural, Civil, or Structural Drawings. General Contractor is to provide all housekeeping and equipment pads shown on Architectural, Civil, and Structural Drawings.
22. Furnish any embeds required to be cast in concrete or masonry to the appropriate Prime Contractor that would not be considered part of the building structure or any wall assembly but required as a result of this contract.
23. Provide any miscellaneous structural framing and decking as required to ensure a complete installation of items that are a part of this Contract.
24. Provide fireblocking/firestopping at all locations that are required to maintain a fire rating at floor and wall penetrations required as a result of the Work of this Contract.
25. Provide all insulation required for the scope of this Contract.
26. Furnish any access panels, which are required for, access to the Work by this Contract. Coordinate opening requirements with the General Contractor. Provide floor access boxes as specified.
27. Coordinate/layout openings required for all exterior louvers and vents in existing building and new construction with the General Contractor.
28. Provide final Mechanical connections of Owner furnished equipment, as shown or specified.
29. Coordinate tie-in of ventilation control system and equipment and duct smoke detectors to fire alarm system with Electrical Contractor.
30. Motor starters for packages Mechanical equipment shall be furnished by the Mechanical Contractor; loose starters and disconnect switchers shall be furnished and installed by Electrical Contractor. Starter connections to be installed by the EC.
31. Provide heat tracing for own Work. Final connection to power source by Electrical Contractor.
32. Install duct smoke detectors furnished by the Electrical Contractor.
33. Work must be complete, operational and tested to meet the requirements of state and local codes.
34. Owner will be providing a commissioning agent. Contractor shall coordinate all work with Owner's Commissioning Agent.

- 1 35. Coordinate all roof penetrations with the General Contractor. General Contractor is responsible to  
2 cut and flash in all penetrations in the roof, new and existing.  
3 36. Prior to tying into the existing building's systems, all piping should be tested. Provide test reports  
4 for record.

5 C. Temporary facilities and controls in the Plumbing Contract include, but are not limited to, the following:

- 6 1. Permanent and/or temporary heating, ventilation, dehumidification, and air conditioning (HVAC)  
7 from unit start-up to Substantial Completion for each new construction building area. If existing  
8 equipment is utilized for temporary heating, ventilation, and air conditioning (HVAC), installation  
9 of filter material is required at all open ductwork, unit filters are to be replaced weekly, all existing  
10 ductwork to remain is to be cleaned and certified, and warranties are to commence at Substantial  
11 Completion.  
12 2. If approved by owner, operation of the new mechanical systems for occupied areas during  
13 construction is allowed for temporary use.

14 1.12 CONTRACT 4 - ELECTRICAL CONTRACT

- 15 A. Work of the Electrical Contract shall include all labor, material, equipment and services necessary for the  
16 complete construction of all electrical service and distribution, lighting, electronic security rough-ins,  
17 low-voltage data and telecommunications rough-ins, and fire alarm Work shown on the General  
18 Information (G-series) Drawings, MPEFP Cover Sheet, Electrical (E-series) Drawings, Low Voltage  
19 System (TA-series) Drawings, and described in Divisions 00, 01, 26, 27, and 28 of the Specifications and  
20 may include other Divisions where noted. Include all Electrical connections to equipment furnished by  
21 the General Construction Contract, Plumbing Contract, Mechanical Contract, and Elevator Contract.  
22 Include close coordination with all other Contractors.

23 Work in the Electrical Contract includes, but is not limited to, the following (see also Responsibility  
24 Matrix in PART 3 – EXECUTION):

- 25 1. Exterior and interior building and site lighting.  
26 2. Communications, data, security, fire detection systems, and raceway and power to support Owner-  
27 provided audio/video systems:  
28 3. Special electrical systems, including the following:  
29 a. Uninterruptible power supply systems.  
30 b. Battery power systems.  
31 c. Surge suppression.  
32 4. Electrical connections to equipment furnished by the General Construction Contract, Plumbing  
33 Contract, and Mechanical Contract.  
34 5. Concrete equipment bases (pads) required by Electrical Work.  
35 6. Hoisting required for contract work.  
36 7. Provide Operation and Maintenance instruction manuals and specified training to the Owner  
37 including video taping of sessions.  
38 8. Provide layout for the General Contractor indicating all openings in the new floor and roof decks  
39 that have dimensions larger than 10". Openings with dimensions smaller than 10" shall be  
40 provided by the Electrical Contractor, who shall also provide support steel at these openings as  
41 required for installation by the General Contractor. All other framing, lintels, miscellaneous  
42 supports, etc., required but not specifically shown on the Drawings shall be by this Contractor.  
43 Electrical Contractor should refer to the structural plans for lintel sizes.  
44 9. Provide start up and training as required by the contract documents.  
45 10. Provide painting for "touch up" required to restore "factory finished" equipment and material to its  
46 original condition.

11. Provide all Electrical Work including testing, conduit, wiring and cable, boxes, wiring devices, enclosures, equipment final connections, support devices, identification, switchboards, disconnect switches, primary and secondary grounding, panel boards, motor controls, lighting fixtures, equipment systems, emergency power and lighting, fire alarm, and smoke detection, final Mechanical electrical, fire protection electrical, and plumbing electrical connections, hangers, supports unless specifically designated by the General Contractor, blocking, wall sleeves, flashing, etc., as shown and/or specified.
12. Provide equipment and wiring necessary for installation and interfacing of the following systems:
  - a. Fire Alarm System
  - b. Mechanical Equipment
  - c. Plumbing Equipment
  - d. Fire Protection Equipment
  - e. Lighting Controls, etc.
  - f. Security System – Access Control
  - g. Computer Network Cabling
  - h. Parking lot monitoring system
  - i. Audio Visual Systems
  - j. Distributed Antenna System
  - k. Electronic Safety and Security
  - l. And as designated on drawings and in specifications.
13. Electrical Contractor to provide a complete or partial system for all systems above including conduit, wire, connectors, terminations, patch controls, jacks, testing, equipment, brackets, hardware, layout check out, training, etc.
14. Provide identification of equipment as specified.
15. Provide all cutting, patching, excavation, and backfill, including work for new incoming services, exterior lighting, etc., as necessary to install the Work of this Contract.
16. Provide fire rated backboards for electrical and telephone equipment as shown or specified.
17. Furnish any access panels, which are required for, access to the Work by this Contract. Coordinate opening requirements with the General Contractor. Provide floor access boxes as specified.
18. Provide any housekeeping and equipment pads required for equipment (interior or exterior) that are required for the work of this Contract, but not shown on Architectural, Civil, or Structural Drawings. General Contractor is to provide all housekeeping and equipment pads shown on Architectural, Civil, and Structural Drawings.
19. Furnish any embeds required to be cast in concrete or masonry to the appropriate Prime Contractor, except embeds related to exterior light bases, which are installed by the Electrical Contractor.
20. Provide any miscellaneous structural framing and decking as required to ensure a complete installation of items that are a part of this Contract.
21. Provide concrete encasement of conduit, foundation/base for site lighting, etc., as required for Work by this Contract. Provide waring tape as required. Provide rebar reinforcement as shown on Contract Documents.
22. Provide fireblocking/firestopping at all locations that are required to maintain a fire rating at floor and wall penetrations required as a result of the Work of this Contract.
23. Provide power wiring 120 volts and greater to all Mechanical, Electrical, and Plumbing equipment, shop equipment, etc., as required or shown.
24. Provide final electrical power connection of casework, and equipment as per the Contract Documents and Specifications. Install all electrical wiring and devices within the plastic laminate, wood, and library casework furnished by the respective contractor.
25. The Electrical Contractor shall furnish and install the conduit and wire for all systems using 120 volts and above.
26. Provide testing and documentation of test results for electrical systems as per the Contract Documents.
27. Electrical Contractor shall provide conduit and back boxes, surface metal raceway, pull strings, sleeves to communication closets, and device boxes as required for installation of all communication systems as per the Contract Documents.

28. Electrical Contractor shall provide conduit and back boxes, surface metal raceway, pull strings, and device boxes as required for installation of audio-visual systems as per the Contract Documents.
29. Electrical Contractor to provide and install telephone and data cables for connection to the fire alarm panel, security panel, ATC panels, etc.
30. Electrical Contractor shall provide fire alarm wiring and final connection to fire sprinkler flow and tamper switches as required.
31. Electrical Contractor shall provide heat rise and smoke detector system.
32. Electrical Contractor shall provide wire and power and final connection for magnetic hold open devices installed by the General Contractor for hold open doors.
33. The Electrical Contractor shall be responsible for providing temporary power to heating equipment to prevent freezing of the building.
34. Coordinate with Mechanical Contractor for electrical hook-up of Mechanical equipment to complete all construction-phasing requirements.
35. Provide a complete data system including all wiring, fiber optic cable, MDF and IDF head end equipment, jacks, testing, etc.
36. Provide complete cable TV system including wiring and jacks. TV brackets/video projector mount will be provided by owner for installation by the General Contractor.
37. Provide all inner duct and fireproofing as required for Work of this Contract.
38. Work must be complete, operational, and tested to meet the requirements of state and local codes. Electrical Contractor is to hire an underwriter for all electrical testing.
39. Electrical Contractor shall have temporary power panel on site by June 26, 2024. Temporary power (main feed and poles) to the trailers must be completed by August 5, 2024.
40. Electrical Contractor to coordinate all roof penetrations with the General Contractor. General Contractor to make all penetrations and flash all penetrations in new and existing roofs.

B. Temporary facilities and controls in the Electrical Contract include, but are not limited to, the following:

1. Temporary electric distribution per Division 01 Section 015000 – Temporary Facilities and Controls.
2. Temporary power and data to the construction trailers.
3. Temporary construction power and temporary construction lighting.
4. Electrical connections to existing systems and temporary facilities and controls furnished by the General Construction Contract.

1.13 CONTRACT 5 - ELEVATOR CONTRACT

A. Work of the Elevator Contract shall include all labor, material, equipment and services necessary for the complete construction of all elevator work shown on the Drawings and described in Divisions 00, 01, and 14 of the Specifications and may include other divisions where noted.

1. Elevator Contractor will be responsible for the cost of up to and including two Labor and Industry elevator inspections. Any cost associated with additional inspections beyond the second inspection will be equally distributed to the parties that were responsible for the previous failure.

PART 2 - PRODUCTS (Not Used)

## 1 PART 3 - EXECUTION

2 **RESPONSIBILITY MATRIX**

ITEMS	Specified by Architect	Specified by Engineers	Furnish by GC	Furnish by Trade	Install by GC	Install by Trade
Concrete Pads		X		X		X
Painting MPEFP Equipment	X		X		X	
Louvers		X		X	X	
Core Holes		X				X
Sleeves		X		X		X
Wall Penetrations MPE Equip.		X				X
Lintels	X		X		X	
Roof Penetrations MPE Equip.		X				X
Floor Penetrations MPE Equip.		X				X
Patch and Repair (Interior partitions, floors, ceilings)		X		X		X
Patch and Repair (Building Envelope)	X		X		X	
Roof Drains		X		X	X	
Roof Curbs		X		X		X
Roof Flashing (MPE Equipment)	X		X		X	
Roof Counter Flashing (MPE Equipment)		X		X		X
Floor Drains		X		X	X	
Trench Drains		X		X	X	
Supplemental Materials MPE Equip.		X		X		X
<b>Utilities Interior – (5 feet)</b>						
- Sanitary, Water, Fire, Storm		X		X		X
- Electric		X		X		X
- Telephone		X		X		X
- Excavation/shoring/ pumping/backfilling		X		X		X
- Testing & Flushing		X		X		X
Site Utilities, Excavating, Shoring, Backfill, Flush, Test	X		X		X	
Site Utilities, Excavating, Shoring, Backfill, Flush, Test	X		X		X	
Site Lights	X		X			X
Site Light Conduits		X			X	
Site Light Circuits		X		X		X
Site Pole Bases	X		X		X	
Site Empty Conduits (Future)		X	X		X	
Temporary						
- Heat	X		X		X	
- Electric	X		X		X	
- Water	X		X		X	
Solid/Sand/Oil/Water Interceptor (Coordinate with Civil Engineer)	X		X		X	

1     END OF SECTION 011200



1 SECTION 012200 - UNIT PRICES

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes administrative and procedural requirements for unit prices.

- 8 B. Related Sections include the following:

- 9 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling  
10 Change Orders.  
11 2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

12 1.3 DEFINITIONS

- 13 A. Unit price is an amount proposed by bidders, stated on the Bid Proposal Form, applicable during the  
14 duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion  
15 of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of  
16 Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

17 1.4 PROCEDURES

- 18 A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes,  
19 overhead, and profit.

- 20 B. Measurement and Payment: Refer to individual Specification Sections for work that requires  
21 establishment of unit prices. Methods of measurement and payment for unit prices are specified in those  
22 Sections.

- 23 C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of  
24 established unit prices and to have this work measured, at Owner's expense, by an independent surveyor  
25 acceptable to Contractor.

- 26 D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the  
27 schedule contain requirements for materials described under each unit price.

28 PART 2 - PRODUCTS (Not Used)

29

## 1 PART 3 - EXECUTION

## 2 3.1 LIST OF UNIT PRICES

## 3 A. Unit Price No. GC-01: Removal of unsatisfactory soil and replacement with satisfactory soil material.

4 1. Description: Unsatisfactory soil excavation and disposal off site and replacement with satisfactory  
5 fill material or engineered fill from off site, as required, in accordance with Division 31 Section  
6 "Earth Moving."

7 2. Unit of Measurement: Cubic yard of soil excavated, based upon survey of volume removed.

## 8 B. Unit Price No. GC-02: Miscellaneous and structural steel.

9 1. Description: Miscellaneous lintels and other supports not otherwise indicated in the Contract  
10 Documents, in accordance with Division 05 Sections "Structural Steel Framing" and "Metal  
11 Fabrications."

12 2. Unit of Measurement: Cost in place of pounds of fabricated steel as indicated on itemized invoice  
13 of steel supplier and verified by the Architect.

## 14 END OF SECTION 012200

## 1 SECTION 012300 - ALTERNATES

## 2 PART 1 - GENERAL

## 3 1.1 RELATED DOCUMENTS

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

## 6 1.2 SUMMARY

- 7 A. This Section includes administrative and procedural requirements for alternates.

## 8 1.3 DEFINITIONS

- 9 A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the  
10 Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to  
11 accept a corresponding change either in the amount of construction to be completed or in the products,  
12 materials, equipment, systems, or installation methods described in the Contract Documents.
- 13 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.  
14 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to  
15 incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

## 16 1.4 PROCEDURES

- 17 A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the  
18 alternate into Project.
- 19 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items  
20 incidental to or required for a complete installation whether or not indicated as part of alternate.
- 21 B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the  
22 status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later  
23 consideration. Include a complete description of negotiated modifications to alternates.
- 24 C. Execute accepted alternates under the same conditions as other work of the Contract.
- 25 D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections  
26 referenced in schedule contain requirements for materials necessary to achieve the work described under  
27 each alternate.

28 PART 2 - PRODUCTS (Not Used)  
29

## PART 3 - EXECUTION

## 3.1 SCHEDULE OF ALTERNATES

- A. The Schedule of Alternates shall be as noted on the contract documents and as enumerated on the Bid Form.
- B. Alternate No. GC-01: RACP Compliance Requirements
1. Base Bid: The base bid does not include RACP Compliance Requirements.
  2. Alternate: In addition to requirements of the base bid, provide all Work in accordance with Document 004445 RACP Compliance Requirements.
- C. Alternate No. GC-02: Vehicle Shelter
1. Base Bid: The base bid does not include the Vehicle Shelter.
  2. Alternate: Provide all Work of this contract associated with the Vehicle Shelter.
- D. Alternate No. GC-03: Scope of Elevator Construction Contract
1. Base Bid: The base bid does not include the scope of the elevator.
  2. Alternate: Provide all Work associated with the hydraulic elevator as documented on the drawings and as specified in Section 142400 – Hydraulic Elevators.
- E. Alternate No. PC-01: RACP Compliance Requirements
1. Base Bid: The base bid does not include RACP Compliance Requirements.
  2. Alternate: In addition to requirements of the base bid, provide all Work in accordance with Document 004445 RACP Compliance Requirements.
- F. Alternate No. MC-01: RACP Compliance Requirements
1. Base Bid: The base bid does not include RACP Compliance Requirements.
  2. Alternate: In addition to requirements of the base bid, provide all Work in accordance with Document 004445 RACP Compliance Requirements.
- G. Alternate No. EC-01: RACP Compliance Requirements
1. Base Bid: The base bid does not include RACP Compliance Requirements.
  2. Alternate: In addition to requirements of the base bid, provide all Work in accordance with Document 004445 RACP Compliance Requirements.
- H. Alternate No. EC-02: Vehicle Shelter
1. Base Bid: The base bid does not include the Vehicle Shelter.
  2. Alternate: Provide all Work of this contract associated with the Vehicle Shelter.
- I.
- J.

- 1       K.     Alternate No. 02: Shunt Trip Breaker
- 2             1.     Base Bid: The base bid includes a shunt trip breaker and heat detectors in the elevator machine
- 3                 room and shaft.
- 4             2.     Alternate: In lieu of the base bid requirements, coordinate sprinkler requirements of elevator shaft
- 5                 with the sprinkler contractor.
- 6       L.     Alternate No. 03: Prevailing Wage Determination 23-09617
- 7             1.     Base Bid: The base bid does not include Prevailing Wage requirements.
- 8             2.     Alternate: In lieu of base bid, provide all labor for this Contract in conformance with the
- 9                 Prevailing Wage Rates outlined in Section 004450-02 – Wage Determination 23-09617 that has
- 10                been modified as part of the Addendum No. 04.
- 11    END OF SECTION 012300

1 SECTION 012500 - SUBSTITUTION PROCEDURES

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section includes administrative and procedural requirements for substitutions.

- 8 B. Related Sections:

- 9 1. Section 012100 "Allowances" for products selected under an allowance.  
10 2. Section 012300 "Alternates" for products selected under an alternate.  
11 3. Section 016000 "Product Requirements" for requirements for submitting comparable product  
12 submittals for products by listed manufacturers.  
13 4. Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

14 1.3 DEFINITIONS

- 15 A. Substitutions: Changes in products, materials, equipment, and methods of construction from those  
16 required by the Contract Documents and proposed by Contractor.

- 17 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project  
18 conditions, such as unavailability of product, regulatory changes, or unavailability of required  
19 warranty terms.  
20 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in  
21 order to meet other Project requirements but may offer advantage to Contractor or Owner.

22 1.4 SUBMITTALS

- 23 A. Substitution Requests: Submit three copies of each request for consideration. Identify product or  
24 fabrication or installation method to be replaced. Include Specification Section number and title and  
25 Drawing numbers and titles.

- 26 1. Substitution Request Form: Use CSI Form 13.1A.  
27 2. Documentation: Show compliance with requirements for substitutions and the following, as  
28 applicable:  
29 a. Statement indicating why specified product or fabrication or installation cannot be  
30 provided, if applicable.  
31 b. Coordination information, including a list of changes or modifications needed to other parts  
32 of the Work and to construction performed by Owner and separate contractors, that will be  
33 necessary to accommodate proposed substitution.  
34

- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC.
- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
- b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

#### 1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

#### 1.6 PROCEDURES

- A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

## PART 2 - PRODUCTS

## 2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider requests for substitution if received within sixty (60) days after the Notice to Proceed issued by Architect. Requests received after that time may be considered or rejected at discretion of Architect.

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.

c. Requested substitution is consistent with the Contract Documents and will produce indicated results.

d. Substitution request is fully documented and properly submitted.

e. Requested substitution will not adversely affect Contractor's construction schedule.

f. Requested substitution has received necessary approvals of authorities having jurisdiction.

g. Requested substitution is compatible with other portions of the Work.

h. Requested substitution has been coordinated with other portions of the Work.

i. Requested substitution provides specified warranty.

j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

## PART 3 - EXECUTION (Not Used)

END OF SECTION 012500



SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications prepared by the Architect.
1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

#### 1.5 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

#### 1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

#### 1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

1 SECTION 012900 - PAYMENT PROCEDURES

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section specifies administrative and procedural requirements necessary to prepare and process  
8 Applications for Payment.

- 9 B. Related Sections include the following:

- 10 1. Document 006100 "Partial Waiver of Lien to Date" for form of Partial Waiver of Lien to Date  
11 required for submittal with each Application for Payment.  
12 2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.  
13 3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling  
14 changes to the Contract.  
15 4. Section 013200 "Construction Progress Documentation" for administrative requirements  
16 governing the preparation and submittal of the Contractor's construction schedule.

17 1.3 DEFINITIONS

- 18 A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to  
19 various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

20 1.4 SCHEDULE OF VALUES

- 21 A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's  
22 Construction Schedule.

- 23 1. Coordinate line items in the schedule of values with other required administrative forms and  
24 schedules, including the following:

- 25 a. Application for Payment forms with Continuation Sheets.  
26 b. Submittals Schedule.  
27 c. Items required to be indicated as separate activities in Contractor's Construction Schedule.

- 28 2. Submit the Schedule of Values to Architect at earliest possible date but no later than ten days  
29 before the date scheduled for submittal of initial Applications for Payment.

- 30 B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the  
31 Schedule of Values. Provide at least one line item for each Specification Section.  
32

1. Identification: Include the following Project identification on the Schedule of Values:

- a. Project name and location.
- b. Name of Architect.
- c. Architect's project number.
- d. Contractor's name and address.
- e. Date of submittal.

2. Submit draft of AIA Document G703 Continuation Sheets.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.

- a. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training in the amount of 5 percent of the Contract Sum.

4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

- a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

- a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

- 1 C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets  
2 as form for Applications for Payment. Reproductions of AIA Documents are not permitted and shall bear  
3 a seal noting authenticity as an original.
- 4 D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to  
5 sign legal documents on behalf of Contractor. Architect will return incomplete applications without  
6 action.
- 7 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use  
8 updated schedules if revisions were made.
- 9 2. Include amounts for work completed following previous Application for Payment, whether or not  
10 payment has been received. Include only amounts for work completed at time of Application for  
11 Payment.
- 12 3. Include amounts of Change Orders and Construction Change Directives issued before last day of  
13 construction period covered by application.
- 14 a. Amounts for Change Orders charged against the Contingency Allowance shall be indicated  
15 under the Contingency Allowance entry.
- 16 E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment  
17 purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and  
18 items stored off-site.
- 19 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to  
20 payment, for stored materials.
- 21 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match  
22 amount requested with amounts indicated on documentation; do not include overhead and profit  
23 on stored materials.
- 24 3. Provide summary documentation for stored materials indicating the following:
- 25 a. Materials previously stored and included in previous Applications for Payment.
- 26 b. Work completed for this Application utilizing previously stored materials.
- 27 c. Additional materials stored with this Application.
- 28 d. Total materials remaining stored, including materials with this Application.
- 29 F. Transmittal: Submit three (3) signed and notarized ORIGINAL copies of each Application for Payment  
30 to Architect by a method ensuring receipt.
- 31 1. Transmit each copy with a transmittal form listing attachments and recording appropriate  
32 information about application.
- 33 2. Applications for payment shall be original copies of the AIA Document G702 and  
34 AIA Document G703. Re-typed facsimiles of these original forms are not permitted. Color  
35 copies are not permitted.
- 36 G. Partial Waiver of Lien to Date: With each Application for Payment, submit Document 006100 - Partial  
37 Waiver of Lien to Date from entities lawfully entitled to file a lien arising out of the Contract and related  
38 to the Work covered by the payment.
- 39 1. Waiver Form: Submit Document 006100 - Partial Waiver of Lien to Date.
- 40 H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide  
41 with submittal of first Application for Payment include the following:
- 42 1. List of subcontractors.

2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

1 SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes administrative provisions for coordinating construction operations on Project  
8 including, but not limited to, the following:

- 9 1. General project coordination procedures.  
10 2. Requests for Interpretation (RFI).  
11 3. Project meetings.

12 B. Related Requirements:

- 13 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's  
14 construction schedule.  
15 2. Section 017300 "Execution" for procedures for coordinating general installation and field-  
16 engineering services, including establishment of benchmarks and control points.  
17 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

18 1.3 DEFINITIONS

- 19 A. BIM: Building Information Modeling.

- 20 B. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents during  
21 construction.

22 1.4 INFORMATIONAL SUBMITTALS

- 23 A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion  
24 of the Work, including those who are to furnish products or equipment fabricated to a special design.  
25 Include the following information in tabular form:

- 26 1. Name, address, and telephone number of entity performing subcontract or supplying products.  
27 2. Number and title of related Specification Section(s) covered by subcontract.  
28 3. Drawing number and detail references, as appropriate, covered by subcontract.

29 1.5 GENERAL COORDINATION PROCEDURES

- 30 A. Coordination: Coordinate construction operations included in different Sections of the Specifications to  
31 ensure efficient and orderly installation of each part of the Work. Coordinate construction operations,  
32 included in different Sections, that depend on each other for proper installation, connection, and  
33 operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

#### 1.6 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect.
5. RFI number, numbered sequentially and beginning with "RFI No. 001".
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.



11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

- a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. RFI Forms:

1. RFI and all attachments shall be electronic files in Adobe Acrobat PDF format.

D. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.

1. RFI and all attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven (7) working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

- a. Requests for approval of submittals.  
b. Requests for approval of substitutions.  
c. Requests for coordination information already indicated in the Contract Documents.  
d. Requests for adjustments in the Contract Time or the Contract Sum.  
e. Requests for interpretation of Architect's actions on submittals.  
f. Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

- a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within seven (7) days of receipt of the RFI response.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

G. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log with not less than the following:

1. Project name.  
2. Name and address of Contractor.  
3. Name and address of Architect.  
4. RFI number including RFIs that were dropped and not submitted.  
5. RFI description.  
6. Date the RFI was submitted.  
7. Date Architect's response was received.  
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

## 1.7 PROJECT MEETINGS

## A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner, Architect, and Construction Manager of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

## B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 10 days after execution of the Agreement. The conference will be held at Project site.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractors and their superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and be authorized to conclude matters relating to the Work.
3. Agenda: The following items of significance that could affect progress, including the following, will be discussed:
  - a. Tentative construction schedule.
  - b. Phasing.
  - c. Critical work sequencing and long-lead items.
  - d. Designation of key personnel and their duties.
  - e. Lines of communication.
  - f. Procedures for processing field decisions and Change Orders.
  - g. Procedures for requests for interpretations (RFIs).
  - h. Procedures for testing and inspecting.
  - i. Procedures for processing Applications for Payment.
  - j. Distribution of the Contract Documents.
  - k. Submittal procedures.
  - l. Preparation of Record Documents.
  - m. Use of the premises and existing buildings.
  - n. Work restrictions.
  - o. Working hours.
  - p. Owner's occupancy requirements.
  - q. Responsibility for temporary facilities and controls.
  - r. Procedure for moisture and mold control.
  - s. Construction waste management and recycling.
  - t. Parking availability.
  - u. Office, work, and storage areas.
  - v. Equipment deliveries and priorities.
  - w. First aid.
  - x. Security.
  - y. Progress cleaning.
4. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

- 1 C. Preinstallation Conferences: Conduct a preinstallation conference at the Project site before each  
2 construction activity that requires coordination with other construction.
- 3 1. Attendees: Contractors and affected Subcontractors, Installers and representatives of  
4 manufacturers and fabricators, and other appropriate parties involved in or affected by the  
5 installation and its coordination or integration with other materials and installations that have  
6 preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
- 7 2. Agenda: Review progress of other construction activities and preparations for the particular  
8 activity under consideration, including requirements for the following:
- 9 a. The Contract Documents.  
10 b. Options.  
11 c. Related requests for interpretations (RFIs).  
12 d. Related Change Orders.  
13 e. Purchases.  
14 f. Deliveries.  
15 g. Submittals.  
16 h. Review of mockups.  
17 i. Possible conflicts.  
18 j. Compatibility problems.  
19 k. Time schedules.  
20 l. Weather limitations.  
21 m. Manufacturer's written recommendations.  
22 n. Warranty requirements.  
23 o. Compatibility of materials.  
24 p. Acceptability of substrates.  
25 q. Temporary facilities and controls.  
26 r. Space and access limitations.  
27 s. Regulations of authorities having jurisdiction.  
28 t. Testing and inspecting requirements.  
29 u. Installation procedures.  
30 v. Coordination with other work.  
31 w. Required performance results.  
32 x. Protection of adjacent work.  
33 y. Protection of construction and personnel.
- 34 3. Record significant discussions, agreements, and disagreements, including required corrective  
35 measures and actions.
- 36 4. Reporting: Distribute minutes of the meeting to each party present, to parties who should have  
37 been present, and to the Architect.
- 38 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate  
39 actions necessary to resolve impediments to performance of the Work and reconvene the  
40 conference at earliest feasible date.
- 41 D. Progress Meetings: Conduct progress meetings at biweekly intervals, at the Project site, unless the  
42 Architect determines that the frequency should be altered to reflect Project conditions.
- 43 1. Attendees: In addition to representatives of Owner and Architect, each Contractor, their  
44 Subcontractors, suppliers, and other entities concerned with current progress or involved in  
45 planning, coordination, or performance of future activities shall be represented at these meetings.  
46 All participants at the meeting shall be familiar with Project and authorized to conclude matters  
47 relating to the Work.
- 48 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other  
49 items of significance that could affect progress. Include topics for discussion as appropriate to  
50 status of Project.

- a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Review present and future needs of each entity present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Progress cleaning.
    - 10) Quality and work standards.
    - 11) Status of correction of deficient items.
    - 12) Field observations.
    - 13) Status of requests for interpretations (RFIs).
    - 14) Status of proposal requests.
    - 15) Pending changes.
    - 16) Status of Change Orders.
    - 17) Pending claims and disputes.
    - 18) Documentation of information for payment requests.
3. Reporting: Record and distribute minutes of the meeting to the Owner, Architect, and each Contractor. Further distribution is the responsibility of party mentioned for their respective Consultants, Subcontractors, each party present, and to parties who should have been present.
  - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Coordination Meetings: Conduct Project coordination meetings at biweekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
  1. Attendees: Each Contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties

involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor present, including the following:

- 1) Interface requirements.
- 2) Sequence of operations.
- 3) Status of submittals.
- 4) Deliveries.
- 5) Off-site fabrication.
- 6) Access.
- 7) Site utilization.
- 8) Temporary facilities and controls.
- 9) Work hours.
- 10) Hazards and risks.
- 11) Progress cleaning.
- 12) Quality and work standards.
- 13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Start-up Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.

- B. Related Sections include the following:

1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

- B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

- E. Event: The starting or ending point of an activity.

- 1 F. Float: The measure of leeway in starting and completing an activity.
- 2 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly  
3 owned, expiring Project resource available to both parties as needed to meet schedule milestones  
4 and Contract completion date.
- 5 2. Free float is the amount of time an activity can be delayed without adversely affecting the early  
6 start of the successor activity.
- 7 3. Total float is the measure of leeway in starting or completing an activity without adversely  
8 affecting the planned Project completion date.
- 9 G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater  
10 detail.
- 11 H. Major Area: A story of construction, a separate building, or a similar significant construction element.
- 12 I. Milestone: A key or critical point in time for reference or measurement.
- 13 J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity  
14 relationships.
- 15 K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an  
16 activity as scheduled.

17 1.4 INFORMATIONAL SUBMITTALS

- 18 A. Format for Submittals: Submit required submittals in the following format:
- 19 1. PDF electronic file.
- 20 B. Submittals Schedule: Submit PDF electronic file of schedule. Arrange the following information in a  
21 tabular format:
- 22 1. Scheduled date for first submittal.
- 23 2. Specification Section number and title.
- 24 3. Submittal category (action or informational).
- 25 4. Name of subcontractor.
- 26 5. Description of the Work covered.
- 27 6. Scheduled date for Architect's and Construction Manager's final release or approval.
- 28 C. Startup Construction Schedule.
- 29 D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire  
30 construction period.
- 31 E. Daily Construction Reports: Submit at weekly intervals.
- 32 F. Site Condition Reports: Submit at time of discovery of differing conditions.
- 33 G. Special Reports: Submit at time of unusual event.

## 1.5 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. Review submittal requirements and procedures.
11. Review procedures for updating schedule.

## 1.6 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
1. Secure time commitments for performing critical elements of the Work from parties involved.
  2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

## 2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
  2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
    - a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
  3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.



## 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 7 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

- a. Subcontract awards.
- b. Submittals.
- c. Purchases.
- d. Mockups.
- e. Fabrication.
- f. Sample testing.
- g. Deliveries.
- h. Installation.
- i. Tests and inspections.
- j. Adjusting.
- k. Curing.
- l. Startup and placement into final use and operation.

2. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

- a. Structural completion.
- b. Permanent space enclosure.
- c. Completion of mechanical installation.
- d. Completion of electrical installation.
- e. Substantial Completion.

- 1 E. Computer Software: Prepare schedules using a program that has been developed specifically to manage  
2 construction schedules.

3 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- 4 A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type,  
5 Contractor's Construction Schedule within thirty (30) days of date established for the Notice to Proceed.  
6 Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was  
7 received since the start of Project.

- 8 B. Preparation: Indicate each significant construction activity separately. Identify first workday of each  
9 week with a continuous vertical line.

- 10 1. For construction activities that require 3 months or longer to complete, indicate an estimated  
11 completion percentage in 10 percent increments within time bar.

12 2.4 REPORTS

- 13 A. Daily Construction Reports: Prepare a daily construction report recording the following information  
14 concerning events at Project site:

- 15 1. List of subcontractors at Project site.  
16 2. List of separate contractors at Project site.  
17 3. Approximate count of personnel at Project site.  
18 4. Equipment at Project site.  
19 5. Material deliveries.  
20 6. High and low temperatures and general weather conditions.  
21 7. Accidents.  
22 8. Meetings and significant decisions.  
23 9. Unusual events (refer to special reports).  
24 10. Stoppages, delays, shortages, and losses.  
25 11. Meter readings and similar recordings.  
26 12. Emergency procedures.  
27 13. Orders and requests of authorities having jurisdiction.  
28 14. Change Orders received and implemented.  
29 15. Construction Change Directives received and implemented.  
30 16. Services connected and disconnected.  
31 17. Equipment or system tests and startups.  
32 18. Partial Completions and occupancies.  
33 19. Substantial Completions authorized.

- 34 B. Site Condition Reports: Immediately on discovery of a difference between field conditions and the  
35 Contract Documents, prepare and submit a detailed report. Submit with a Request for Information.  
36 Include a detailed description of the differing conditions, together with recommendations for changing  
37 the Contract Documents.

## 1 PART 3 - EXECUTION

## 2 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

3 A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual  
4 construction progress and activities. Issue schedule one week before next regularly scheduled progress  
5 meeting.

6 1. Revise schedule immediately after each meeting or other activity where revisions have been  
7 recognized or made. Issue updated schedule concurrently with the report of each such meeting.

8 2. Include a report with updated schedule that indicates every change, including, but not limited to,  
9 changes in logic, durations, actual starts and finishes, and activity durations.

10 3. As the Work progresses, indicate Actual Completion percentage for each activity.

11 B. Distribution: Distribute copies to Architect, separate contractors, testing and inspecting agencies, and  
12 other parties identified by Contractor with a need-to-know schedule responsibility.

13 1. Post copies in Project meeting rooms and temporary field offices.

14 2. When revisions are made, distribute updated schedules to the same parties and post in the same  
15 locations. Delete parties from distribution when they have completed their assigned portion of the  
16 Work and are no longer involved in performance of construction activities.

17 END OF SECTION 013200

1 SECTION 013300 - SUBMITTAL PROCEDURES

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product  
8 Data, Samples, and other submittals.

- 9 B. Related Sections include the following:

- 10 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule  
11 of values.  
12 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports,  
13 including Contractor's construction schedule.  
14 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance  
15 manuals.  
16 4. Section 017839 "Project Record Documents" for submitting record Drawings, record  
17 Specifications, and record Product Data.  
18 5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration  
19 of equipment and training of Owner's personnel.

20 1.3 DEFINITIONS

- 21 A. Action Submittals: Written and graphic information that requires Architect's responsive action. Action  
22 submittals are those submittals indicated in individual Specification Sections as "action submittals."

- 23 B. Informational Submittals: Written information that does not require Architect's approval. Submittals  
24 may be rejected for not complying with requirements. Informational submittals are those submittals  
25 indicated in individual Specification Sections as "informational submittals."

- 26 C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another  
27 computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a  
28 portion of a network located outside of network firewalls within which internal and external users are  
29 able to access files.

- 30 D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for  
31 representing documents in a device-independent and display resolution-independent fixed-layout  
32 document format.

33 1.4 ACTION SUBMITTALS

- 34 A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required  
35 by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and  
36 delivery when establishing dates. Include additional time required for making corrections or revisions to

submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

- a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

- a. Scheduled date for first submittal.
- b. Specification Section number and title.
- c. Submittal category: Action; informational.
- d. Name of subcontractor.
- e. Description of the Work covered.
- f. Scheduled date for Architect's final release or approval.
- g. Scheduled date of fabrication.
- h. Scheduled dates for purchasing.
- i. Scheduled dates for installation.
- j. Activity or event number.

#### 1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use as follows:

1. Architect will furnish Contractor one digital drawing file, as noted below, for use in reproducing drawings, managing as-built conditions, and preparing Project record drawings.

- a. Format: Portable Document Format (PDF)
- b. The following digital drawing files will be furnished:

- 1) Complete set of Contract Documents.

2. Architect will furnish Contractor one digital data drawing file, as noted below, for use in preparing Shop Drawings and Project record drawings.

- a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
- b. Digital Drawing Software Program: The Contract Drawings are available in Autocad 2013 DWG file format for Windows operating system.
- c. Contractor shall execute a data licensing agreement in the form of form acceptable to Architect.
- d. The following digital data files will be furnished for each appropriate discipline:

- 1) Architectural floor plans ONLY.

- 1 B. Coordination: Coordinate preparation and processing of submittals with performance of construction  
2 activities.
- 3 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and  
4 related activities that require sequential activity.
- 5 2. Submit all submittal items required for each Specification Section concurrently unless partial  
6 submittals for portions of the Work are indicated on approved submittal schedule.
- 7 3. Submit action submittals and informational submittals required by the same Specification Section  
8 as separate packages under separate transmittals.
- 9 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing  
10 will not be delayed because of need to review submittals concurrently for coordination.
- 11 a. Architect reserves the right to withhold action on a submittal requiring coordination with  
12 other submittals until related submittals are received.
- 13 C. Submittals Schedule: Comply with requirements in Section 013200 "Construction Progress  
14 Documentation" for list of submittals and time requirements for scheduled performance of related  
15 construction activities.
- 16 D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows.  
17 Time for review shall commence on Architect's receipt of submittal. No extension of Contract Time will  
18 be authorized because of failure to transmit submittals enough in advance of the work to permit  
19 processing, including resubmittals.
- 20 1. Initial Review: Allow fourteen (14) days for initial review by the Architect. Allow additional  
21 time if processing must be delayed to permit coordination with subsequent submittals. Architect  
22 will advise Contractor when a submittal being processed must be delayed for coordination.
- 23 2. Consultant Review: Where review of submittals by Architect's consultants, Owner, or other  
24 parties is required, allow fourteen (14) days for initial review of each submittal.
- 25 3. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial  
26 submittal.
- 27 4. Resubmittal Review: Allow 14 days for processing each resubmittal.
- 28 E. Electronic Submittals: Submittals shall be prepared and transmitted electronically. Identify and  
29 incorporate information in each electronic submittal file as follows:
- 30 1. Assemble complete submittal package into a single indexed file incorporating submittal  
31 requirements of a single Specification Section and transmittal form with links enabling navigation  
32 to each item.
- 33 2. Name file with submittal number or other unique identifier, including revision identifier.
- 34 a. Submittal number shall use Specification Section number followed by a dash mark and  
35 then a sequential three digit number followed by a dash and then a single digit number to  
36 indicate the issue or revision number (e.g., 047200-001-1).
- 37 3. Provide means for insertion to permanently record Contractor's review and approval markings and  
38 action taken by Architect.
- 39 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing  
40 the following information:
- 41 a. Project name.
- 42 b. Date.
- 43 c. Name and address of Architect.
- 44 d. Name of Contractor.

- 1 e. Name of firm or entity that prepared submittal.
- 2 f. Names of subcontractor, manufacturer, and supplier.
- 3 g. Submittal number including revision number.
- 4 1) Submittal number shall use Specification Section number followed by a dash mark
- 5 and then a sequential three digit number followed by a dash and then a single digit
- 6 number to indicate the issue or revision number (e.g., 047200-001-1).
- 7 h. Number and title of appropriate Specification Section.
- 8 i. Drawing number and detail references, as appropriate.
- 9 j. Location(s) where product is to be installed, as appropriate.
- 10 k. Other necessary identification
- 11 l. Submittal and transmittal distribution record.
- 12 m. Other necessary identification.
- 13 n. Remarks.
- 14 F. Options: Identify options requiring selection by Architect.
- 15 G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's
- 16 letterhead, record relevant information, requests for data, revisions other than those requested by
- 17 Architect on previous submittals, and deviations from requirements in the Contract Documents, including
- 18 minor variations and limitations. Include same identification information as related submittal.
- 19 1. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on
- 20 submittals.
- 21 H. Resubmittals: Make resubmittals in same form as initial submittal.
- 22 1. Note date and content of previous submittal.
- 23 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
- 24 3. Note Submittal number from previous submittal, changing the single digit issue or revision
- 25 number to the next sequential number.
- 26 4. Resubmit submittals until they are marked "Approved" or "Approved as Noted" on the Architect's
- 27 action stamp.
- 28 I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators,
- 29 installers, authorities having jurisdiction, and others as necessary for performance of construction
- 30 activities. Show distribution on transmittal forms.
- 31 J. Use for Construction: Use only final submittals with mark indicating "Furnish as Submitted" or "Revise
- 32 as Noted and Furnish" on the Architect's action stamp, or similar marks on Engineer's action stamp.
- 33 1. Submittals marked with "Revise and Resubmit" or "Rejected" notation from Architect's action
- 34 stamp, or similar marks on Engineer's action stamp, are not to be used in connection with
- 35 construction. Correct items indicated and resubmit submittal.

## 36 PART 2 - PRODUCTS

### 37 2.1 SUBMITTAL PROCEDURES

- 38 A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual
- 39 Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files. The use of Web-Based Project Software is not permitted.

a. Architect will return annotated PDF electronic files. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit in the formats outlined below:

a. PDF electronic file:

1) Submittals requiring Architect's Review: Submittal shall be submitted in the format required by the Contract Documents. The Contractor will transmit one (1) electronic file to Architect. Architect shall review, mark-up, stamp and return one (1) PDF electronic file copy.

2) Submittals requiring Engineering Review: Submittal shall be submitted in the format required by the Contract Documents. The Contractor will transmit one (1) electronic file to Architect, who will in turn transmit one (1) electronic file to the Engineer. Engineer shall review, mark-up, stamp and return one (1) PDF electronic file copy through Architect. Architect shall process and return one (1) PDF electronic file.

3. Informational Submittals: Submit PDF electronic copies of each submittal unless otherwise indicated. Architect will not return copies.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

a. Manufacturer's written recommendations.

b. Manufacturer's product specifications.

c. Manufacturer's installation instructions.

d. Standard color selections on actual material substrate (paper representations are not acceptable).

e. Manufacturer's catalog cuts.

f. Wiring diagrams showing factory-installed wiring.

g. Printed performance curves.

h. Operational range diagrams.

i. Mill reports.

j. Standard product operating and maintenance manuals.

k. Compliance with recognized trade association standards.

l. Compliance with recognized testing agency standards.

m. Application of testing agency labels and seals.

n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:



- a. Dimensions.
  - b. Identification of products.
  - c. Fabrication and installation drawings.
  - d. Roughing-in and setting diagrams.
  - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
  - f. Shopwork manufacturing instructions.
  - g. Templates and patterns.
  - h. Schedules.
  - i. Design calculations.
  - j. Compliance with specified standards.
  - k. Notation of coordination requirements.
  - l. Notation of dimensions established by field measurement.
  - m. Relationship to adjoining construction clearly indicated.
  - n. Seal and signature of professional engineer if specified.
  - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheet layouts at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of appropriate Specification Section.
  3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples not incorporated in the Work, or otherwise designated as Owner's property, are the property of the Contractor.
  4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Samples requiring Architect's Review: Samples shall be submitted in the format required by the Contract Documents. Submit full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Submit three (3) full sets to Architect. Architect shall review, mark-up, stamp and return up to two (2) full sets with options selected. Retain one returned copy as a Project Record Document.
    - b. Samples requiring Engineering Review: Submittal shall be submitted in the format required by the Contract Documents. Submit full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Transmit four (4) full sets to Architect. Engineer shall review, mark-up, stamp and return three (3) full sets through Architect. Architect shall process and return up to two (2) full sets. Retain one returned copy as a Project Record Document.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit Samples for Verification in the same manner and quantity as specified for Samples for Initial Selection.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

2) If variations in color, pattern, texture, or other characteristic is inherent in material or product represented by Sample, submit four sets of paired units that show appropriate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

- 1 M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with  
2 requirements in the Contract Documents. Submit record of Welding Procedure Specification and  
3 Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- 4 N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer  
5 complies with requirements in the Contract Documents and, where required, is authorized by  
6 manufacturer for this specific Project.
- 7 O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that  
8 manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing  
9 experience where required.
- 10 P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product  
11 complies with requirements in the Contract Documents.
- 12 Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material  
13 complies with requirements in the Contract Documents.
- 14 R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard  
15 form, indicating and interpreting test results of material for compliance with requirements in the Contract  
16 Documents.
- 17 S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer  
18 complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by  
19 manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a  
20 qualified testing agency.
- 21 T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities  
22 having jurisdiction, that product complies with building code in effect for Project. Include the following  
23 information:
- 24 1. Name of evaluation organization.  
25 2. Date of evaluation.  
26 3. Time period when report is in effect.  
27 4. Product and manufacturers' names.  
28 5. Description of product.  
29 6. Test procedures and results.  
30 7. Limitations of use.
- 31 U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's  
32 standard form, indicating and interpreting results of tests performed before installation of product, for  
33 compliance with performance requirements in the Contract Documents.
- 34 V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's  
35 standard form, indicating and interpreting results of compatibility tests performed before installation of  
36 product. Include written recommendations for primers and substrate preparation needed for adhesion.
- 37 W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed  
38 either during installation of product or after product is installed in its final location, for compliance with  
39 requirements in the Contract Documents.
- 40 X. Design Data: Prepare and submit written and graphic information, including, but not limited to,  
41 performance and design criteria, list of applicable codes and regulations, and calculations. Include list of  
42 assumptions and other performance and design criteria and a summary of loads. Include load diagrams if  
43 applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

## 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. The Contractor is responsible for dimensions to be confirmed and correlated at the site; and for information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction. Mark with approval stamp before submitting to Architect.

- B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."

- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

## 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

- B. Action Submittals: Architect will review each required submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each required submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. "Furnish as Submitted"  
2. "Revised as Noted and Furnish"

- a. If either of these is checked, fabrication may be undertaken. Review does not authorize changes to Contract Sum or Contract Time unless stated by Change Order or Construction Change Directive.  
b. If box indicated "Submit Revised Copy for Record" is marked, make corrections indicated and resubmit for record.

- 1 3. "Revise and Resubmit"
- 2 4. "Rejected"
- 3 a. If either of these is checked, fabrication or installation may NOT be undertaken. Resubmit
- 4 revised copies for review. Corrections shall be limited to items marked.
- 5 C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and
- 6 return it if it does not comply with requirements.
- 7 D. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without
- 8 review.
- 9 E. Submittals not required by the Contract Documents will not be reviewed and may be discarded.
- 10 END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

- 1 F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill,  
2 factory, or shop.
- 3 G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the  
4 Work and for completed Work.
- 5 H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory  
6 shall mean the same as testing agency.
- 7 I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee,  
8 Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including  
9 installation, erection, application, and similar operations.
- 10 1. Using a term such as "carpentry" does not imply that certain construction activities must be  
11 performed by accredited or unionized individuals of a corresponding generic name, such as  
12 "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople  
13 of the corresponding generic name.
- 14 J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum  
15 of five previous projects similar in size and scope to this Project; being familiar with special requirements  
16 indicated; and having complied with requirements of authorities having jurisdiction.

#### 17 1.4 DELEGATED-DESIGN SERVICES

- 18 A. Performance and Design Criteria: Where professional design services or certifications by a design  
19 professional are specifically required of Contractor by the Contract Documents, provide products and  
20 systems complying with specific performance and design criteria indicated.
- 21 1. If criteria indicated are not sufficient to perform services or certification required, submit a written  
22 request for additional information to Architect.
- 23 2. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible  
24 design professional, for each product and system specifically assigned to Contractor to be  
25 designed or certified by a design professional, indicating that the products and systems are in  
26 compliance with performance and design criteria indicated. Include list of codes, loads, and other  
27 factors used in performing these services

#### 28 1.5 CONFLICTING REQUIREMENTS

- 29 A. Conflicting Standards and Other Requirements: If compliance with two or more standards or  
30 requirements are specified and the standards or requirements establish different or conflicting  
31 requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer  
32 conflicting requirements that are different, but apparently equal, to Architect for direction before  
33 proceeding.
- 34 B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the  
35 minimum provided or performed. The actual installation may comply exactly with the minimum quantity  
36 or quality specified, or it may exceed the minimum within reasonable limits. To comply with these  
37 requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of  
38 requirements. Refer uncertainties to Architect for a decision before proceeding.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agencies specified in “Quality Assurance” Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
  2. Entity responsible for performing tests and inspections.
  3. Description of test and inspection.
  4. Identification of applicable standards.
  5. Identification of test and inspection methods.
  6. Number of tests and inspections required.
  7. Time schedule or time span for tests and inspections.
  8. Entity responsible for performing tests and inspections.
  9. Requirements for obtaining samples.
  10. Unique characteristics of each quality-control service.

## 1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.



C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.

1.8 Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

#### 1.9 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

- a. Provide test specimens representative of proposed products and construction.
- b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
- c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
- d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
- e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
- f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
  - a. Allow seven (7) days for initial review and each re-review of each mockup.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed by the Architect, unless otherwise indicated.

#### 1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish the following quality-control services:

- a. Monitor proof-rolling operations of slab and pavement;
- b. Test compaction of backfill material;
- c. Inspect footing bottoms;

- d. Concrete and reinforcing steel inspection;
  - e. Pile installation;
  - f. Masonry inspection; and
  - g. Structural steel inspection.
2. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  3. Payment for these services will be made by the Owner.
  4. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
- a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Owner's or Contractor's responsibility, Contractor to provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in triplicate, of each test, inspection, and similar quality-control service through Construction Manager.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

F. Associated Services: Contractor to cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Contractor to prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

#### 1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

#### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

##### 3.1 ACCEPTABLE TESTING AGENCIES

A. Contractor shall select from the following testing agencies for their testing requirements:

1. Duffield Associates, Inc., Wilmington, DE

- 1           2.     Ingram Engineering, West Chester, PA
- 2           3.     Pennoni Associates, King of Prussia, PA
- 3           4.     Underwood Testing, Mount Ephraim, PA
- 4           5.     Valley Forge Laboratories, Inc., Devon, PA

5    3.2     TEST AND INSPECTION LOG

- 6       A.     Contractor to prepare a record of tests and inspections. Include the following:

- 7           1.     Date test or inspection was conducted.
- 8           2.     Description of the Work tested or inspected.
- 9           3.     Date test or inspection results were transmitted to Architect and Construction Manager.
- 10          4.     Identification of testing agency or special inspector conducting test or inspection.

- 11       B.     Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and  
12             inspection log for Architect's reference during normal working hours.

13   3.3     REPAIR AND PROTECTION

- 14       A.     General: On completion of testing, inspecting, sample taking, and similar services, repair damaged  
15             construction and restore substrates and finishes.

- 16       B.     Protect construction exposed by or for quality-control service activities.

- 17       C.     Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for  
18             quality-control services.

19   END OF SECTION 014000

1 SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes requirements for temporary utilities, support facilities, and security and protection  
8 facilities.

- 9 B. Related Requirements:

- 10 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

11 1.3 DEFINITIONS

- 12 A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete,  
13 insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with  
14 permanent construction or substantial temporary closures.

15 1.4 USE CHARGES

- 16 A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other  
17 entities to use temporary services and facilities without cost, including, but not limited to, Owner,  
18 Architect, testing agencies, authorities having jurisdiction, other Prime Contractors and Subcontractors.

- 19 1. Contractors cost or usage charges for temporary facilities will not be accepted as the basis for  
20 Change Orders.

- 21 A. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

- 22 B. Water Service: Pay water-service use charges for water used by all entities for construction operations.

- 23 C. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for  
24 construction operations.

25 1.5 INFORMATIONAL SUBMITTALS

- 26 A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction  
27 personnel.

- 28 B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction  
29 General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

#### 1.6 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

#### 1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.

B. Lumber and Plywood: Minimum grades of material as recommended by Industry Grading Agencies for level of service of item being provided.

#### 2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units, or site fabricated offices, with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide shed or trailer sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: General Construction Contract shall provide and maintain portable, UL rated, fire-extinguishers with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  3. If use of permanent heating system is authorized and used for temporary heat, the equipment shall be cleaned and reconditioned, by the Contractor that installed the equipment, prior to substantial completion. Costs associated with cleaning and reconditioning shall be included in the Contract Amount.
  4. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.
  5. General cleaning of the building, prior to substantial completion, shall include the removal of soot, or other deposits, from the use of temporary heaters from surrounding surfaces.

## PART 3 - EXECUTION

## 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Install each temporary facility in accordance with applicable regulations of authorities having jurisdiction.
- D. Operate and maintain each temporary facility in a safe and sanitary condition.

## 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service.
1. Arrange with utility company and adjacent existing property users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of



low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.

b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.

3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.

2. Connect temporary service to Owner's existing power source, as directed by Owner.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

I. Telephone Service: Provide WiFi cell phone access equipment in common-use facilities for use by all construction personnel.

1. Post a list of important telephone numbers.

a. Police and fire departments.

b. Ambulance service.

c. Architect's office.

d. Engineers' offices.

e. Owner's office.

f. Principal subcontractors' field and home offices.

2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

J. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

## 3.3 SUPPORT FACILITIES INSTALLATION

## A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

## B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

## C. Parking: Provide temporary parking areas for construction personnel.

## D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

## E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

## F. Waste Disposal Facilities: Comply with requirements specified in Division 1 Section "Construction Waste Management."

## G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

## 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

## A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 1 Section "Summary."

## B. Temporary Erosion and Sedimentation Control: Contractor shall provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways,

according to requirements of authorities having jurisdiction and as specified in Division 31 Section "Site Clearing."

1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: General Contractor to propose extent of fence as may be appropriate to secure and protect the site, to maintain building access and required building egress, and to maintain site access through the duration of construction.

E. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

G. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, hot or cold weather, other construction operations, and similar activities where weather related damage may be detrimental to new equipment.

J. Temporary Fire Protection: Provide and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in hazardous fire-exposure areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### 3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
  - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 24 hours are considered defective.
  - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
  - c. Remove materials that can not be completely restored to their manufactured moisture level within 24 hours.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

1    END OF SECTION 015000

1 SECTION 016000 - PRODUCT REQUIREMENTS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

- 4 A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and  
5 other Division 1 Specification Sections, apply to this Section.

6 1.2 SUMMARY

- 7 A. This Section includes the following administrative and procedural requirements: selection of products for  
8 use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products;  
9 special warranties; product substitutions; and comparable products.

10 B. Related Requirements:

- 11 1. Section 012100 "Allowances" for products selected under an allowance.  
12 2. Section 012300 "Alternates" for products selected under an alternate.  
13 3. Section 012500 "Substitution Procedures" for requests for substitutions.

14 1.3 DEFINITIONS

- 15 A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from  
16 previously purchased stock. The term "product" includes the terms "material," "equipment," "system,"  
17 and terms of similar intent.

- 18 1. Named Products: Items identified by manufacturer's product name, including make or model  
19 number or other designation, shown or listed in manufacturer's published product literature, that is  
20 current as of date of the Contract Documents.  
21 2. New Products: Items that have not previously been incorporated into another project or facility,  
22 except that products consisting of recycled-content materials are allowed, unless explicitly stated  
23 otherwise. Products salvaged or recycled from other projects are not considered new products.  
24 3. Comparable Product: Product that is demonstrated and approved through submittal process, or  
25 where indicated as a product substitution, to have the indicated qualities related to type, function,  
26 dimension, in-service performance, physical properties, appearance, and other characteristics that  
27 equal or exceed those of specified product.

- 28 B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named  
29 and accompanied by the words "basis-of-design product," including make or model number or other  
30 designation. In addition to the basis-of-design product description, product attributes and characteristics  
31 may be listed to establish the significant qualities related to type, function, in-service performance and  
32 physical properties, weight, dimension, durability, visual characteristics, and other special features and  
33 requirements for purposes of evaluating comparable products of additional manufacturers named in the  
34 specification.

- 35 C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements"  
36 introduces a product selection procedure in an individual Specification Section, provide products  
37 qualified under the specified product procedure. In the event that a named product or product by a named  
38 manufacturer does not meet the other requirements of the specifications, select another named product or

product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

#### 1.4 ACTION SUBMITTALS

- A. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
  - a. Name of product and manufacturer.
  - b. Model and serial number.
  - c. Capacity.
  - d. Speed.
  - e. Ratings.
3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

#### 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

- B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

- 1 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that  
2 products are undamaged and properly protected.

3 C. Storage

- 4 1. Store products to allow for inspection and measurement of quantity or counting of units.  
5 2. Store materials in a manner that will not endanger Project structure.  
6 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure  
7 above ground, with ventilation adequate to prevent condensation.  
8 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation  
9 and concealment.  
10 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation,  
11 and weather-protection requirements for storage.  
12 6. Protect stored products from damage and liquids from freezing.  
13 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by  
14 Owner's construction forces. Coordinate location with Construction Manager.

15 1.7 PRODUCT WARRANTIES

- 16 A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties  
17 required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties  
18 do not relieve Contractor of obligations under requirements of the Contract Documents.

- 19 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a  
20 particular product and specifically endorsed by manufacturer to Owner.  
21 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents,  
22 either to extend time limit provided by manufacturer's warranty or to provide more rights for  
23 Owner.

- 24 B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready  
25 for execution. Submit a draft for approval before final execution.

- 26 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly  
27 executed.  
28 2. Specified Form: When specified forms are included with the Specifications, prepare a written  
29 document using appropriate form properly executed.  
30 3. See other Sections for specific content requirements and particular requirements for submitting  
31 special warranties.

- 32 C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

33 PART 2 - PRODUCTS

34 2.1 PRODUCT SELECTION PROCEDURES

- 35 A. General Product Requirements: Provide products that comply with the Contract Documents, that are  
36 undamaged, and unless otherwise indicated, that are new at time of installation.

- 37 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a  
38 complete installation and indicated use and effect.



2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
    - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
    - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
  2. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
    - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
    - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
    - c. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
- a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

1       D.     Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from  
2             manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect  
3             will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both  
4             standard and premium items.

5     END OF SECTION 016000

1 SECTION 017300 - EXECUTION

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

- 4 A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and  
5 other Division 1 Specification Sections, apply to this Section.

6 1.2 SUMMARY

- 7 A. This Section includes general procedural requirements governing execution of the Work including, but  
8 not limited to, the following:

- 9 1. Construction layout.  
10 2. Field engineering and surveying.  
11 3. Installation of the Work.  
12 4. Cutting and patching.  
13 5. Coordination of Owner-installed products.  
14 6. Progress cleaning.  
15 7. Starting and adjusting.  
16 8. Protection of installed construction.  
17 9. Correction of the Work.

- 18 B. Related Sections include the following:

- 19 1. Section 011000 "Summary" for limits on use of Project site.  
20 2. Section 013300 "Submittal Procedures" for submitting surveys.  
21 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record  
22 Documents, recording of Owner-accepted deviations from indicated lines and levels, and final  
23 cleaning.  
24 4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

25 1.3 DEFINITIONS

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

29 1.4 PREINSTALLATION MEETINGS

- 30 A. Layout Conference: Conduct conference at Project site.

- 31 1. Prior to establishing layout of new perimeter and structural column grid(s), review building  
32 location requirements. Review benchmark, control point, and layout and dimension requirements.  
33 Inform Architect of scheduled meeting. Require representatives of each entity directly concerned  
34 with Project layout to attend, including the following:

- 35 a. Contractor's superintendent.

b. Professional surveyor responsible for performing Project surveying and layout.

2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
3. Review requirements for including layouts on Shop Drawings and other submittals.
4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

#### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

#### 1.6 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

## 3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

## 3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

- 1 B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
- 2 1. Establish benchmarks and control points to set lines and levels at each story of construction and  
3 elsewhere as needed to locate each element of Project.
- 4 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required  
5 dimensions.
- 6 3. Inform installers of lines and levels to which they must comply.
- 7 4. Check the location, level and plumb, of every major element as the Work progresses.
- 8 5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
- 9 6. Close site surveys with an error of closure equal to or less than the standard established by  
10 authorities having jurisdiction.
- 11 C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil  
12 placement, utility slopes, and invert elevations.
- 13 D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building  
14 foundations, column grids, and floor levels, including those required for mechanical and electrical work.  
15 Transfer survey markings and elevations for use with control lines and levels. Level foundations and  
16 piers from two or more locations.
- 17 E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels.  
18 Include beginning and ending dates and times of surveys, weather conditions, name and duty of each  
19 survey party member, and types of instruments and tapes used. Make the log available for reference by  
20 Architect.
- 21 3.4 FIELD ENGINEERING
- 22 A. Identification: Identify existing benchmarks, control points, and property corners.
- 23 B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points  
24 before beginning the Work. Preserve and protect permanent benchmarks and control points during  
25 construction operations.
- 26 1. Do not change or relocate existing benchmarks or control points without prior written approval of  
27 Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the  
28 need to relocate permanent benchmarks or control points to Architect before proceeding.
- 29 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements  
30 on the original survey control points.
- 31 C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site,  
32 referenced to data established by survey control points. Comply with authorities having jurisdiction for  
33 type and size of benchmark.
- 34 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- 35 2. Where the actual location or elevation of layout points cannot be marked, provide temporary  
36 reference points sufficient to locate the Work.
- 37 3. Remove temporary reference points when no longer needed. Restore marked construction to its  
38 original condition.
- 39 D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring  
40 field-engineering services, prepare a certified survey showing dimensions, locations, angles, and  
41 elevations of construction and sitework.

1 E. Final Property Survey: Prepare a final property survey showing significant features (real property) for  
2 Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds,  
3 lines, and levels of Project are accurately positioned as shown on the survey.

- 4 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements  
5 and significant vegetation, adjoining properties, acreage, grade contours, and the distance and  
6 bearing from a site corner to a legal point.
- 7 2. Recording: At Substantial Completion, have the final property survey recorded by or with  
8 authorities having jurisdiction as the official "property survey."

### 9 3.5 INSTALLATION

10 A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as  
11 indicated.

- 12 1. Make vertical work plumb and make horizontal work level.
- 13 2. Where space is limited, install components to maximize space available for maintenance and ease  
14 of removal for replacement.
- 15 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- 16 4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling, unless  
17 otherwise noted.

18 B. Comply with manufacturer's written instructions and recommendations for installing products in  
19 applications indicated.

20 C. Install products at the time and under conditions that will ensure the best possible results. Maintain  
21 conditions required for product performance until Substantial Completion.

22 D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in  
23 excess of that expected during normal conditions of occupancy.

24 E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on  
25 site and placement in permanent locations.

26 F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive  
27 noise levels.

28 G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory  
29 prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate  
30 provisions are made for locating and installing products to comply with indicated requirements.

31 H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and  
32 number to securely anchor each component in place, accurately located and aligned with other portions of  
33 the Work. Where size and type of attachments are not indicated, verify size and type required for load  
34 conditions.

- 35 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights  
36 directed by Architect.
- 37 2. Allow for building movement, including thermal expansion and contraction.
- 38 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for  
39 installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral  
40 anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in  
41 time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

E. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

b. Restore damaged pipe covering to its original condition.



3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

1. Ingress and egress paths to the existing engine bays shall be maintained clear at all times.
2. Ingress and egress paths to the project site to be maintained clear at all times.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.9 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

- 1    3.10    PROTECTION OF INSTALLED CONSTRUCTION
- 2        A.    Provide final protection and maintain conditions that ensure installed Work is without damage or  
3               deterioration at time of Substantial Completion.
- 4        B.    Comply with manufacturer's written instructions for temperature and relative humidity.
- 5    3.11    CORRECTION OF THE WORK
- 6        A.    Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply  
7               with requirements in Division 1 Section "Cutting and Patching."
- 8            1.    Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with  
9               matching materials, and properly adjusting operating equipment.
- 10       B.    Restore permanent facilities used during construction to their specified condition.
- 11       C.    Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without  
12               visible evidence of repair.
- 13       D.    Repair components that do not operate properly. Remove and replace operating components that cannot  
14               be repaired.
- 15       E.    Remove and replace chipped, scratched, and broken glass or reflective surfaces.
- 16    END OF SECTION 017300

1 SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND RECYCLING

2 PART 1 – GENERAL

3 1.1 RELATED DOCUMENTS

- 4 A. Drawings and general provisions of each prime Contract, including General and Supplementary  
5 Conditions and other Division 01 Specification Sections, apply to this Section.

6 1.2 SUMMARY

- 7 A. Section includes administrative and procedural requirements for the following:  
8 1. Recycling nonhazardous demolition and construction waste.  
9 2. Disposing of nonhazardous demolition and construction waste.
- 10 B. Related Sections:  
11 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.  
12 2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and  
13 removal of above- and below-grade improvements.

14 1.3 DEFINITIONS

- 15 A. Construction Waste: Building and site improvement materials and other solid waste resulting from  
16 construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- 17 B. Demolition Waste: Building and site improvement materials resulting from demolition or selective  
18 demolition operations.
- 19 C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or  
20 deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- 21 D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for  
22 reuse.
- 23 E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- 24 F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the  
25 Work.

26 1.4 PERFORMANCE REQUIREMENTS

- 27 A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all  
28 reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate  
29 recycling and salvage of materials, including the following:  
30

## 1. Construction Waste:

- a. Site-clearing waste.
- b. Masonry and CMU.
- c. Lumber.
- d. Wood sheet materials.
- e. Wood trim.
- f. Metals.
- g. Roofing.
- h. Insulation.
- i. Carpet and pad.
- j. Gypsum board.
- k. Piping.
- l. Electrical conduit.
- m. Packaging: Regardless of salvage/recycle goal indicated in paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
  - 1) Paper.
  - 2) Cardboard.
  - 3) Boxes.
  - 4) Plastic sheet and film.
  - 5) Polystyrene packaging.
  - 6) Wood crates.
  - 7) Plastic pails.

## 1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 15 days of date established for the Notice to Proceed. Indicate how Contractor proposes to collect, segregate, and dispose of all construction wastes and debris produced by the work of this Contract. Show compliance with regulations specified under "Quality Assurance" article below. Include a list of recycling facilities to which indicated recyclable materials will be distributed for disposal. Identify materials that are not recyclable or otherwise conservable that must be disposed of in a landfill or other means acceptable under governing State and local regulations. List permitted landfills and/or other disposal means to be employed. Indicate any instances where compliance with requirements of this specification does not appear to be possible and request resolution from the Contracting Officer through the Contracting Officer's Representative.

## 1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with all applicable Federal, State and Local codes and inform Architect and Owner for direction if conflicts occur.
- B. Disposal Sites, Recyclers, and Waste Materials Processors: Use only facilities properly permitted by Federal, State and Local authorities where applicable.
- C. Pre-Construction Waste Management Conference: Prior to beginning work at the site, schedule and conduct a conference to review the Construction Waste Management Plan and discuss procedures, schedules and specific requirements for salvaging, waste materials recycling and disposal. Discuss coordination and interface between the Contractor and other construction activities. Identify and resolve problems with compliance with requirements. Record minutes of the meeting, identifying all conclusions reached and matters requiring further resolution.

1. Attendees: The Contractor and related Contractor personnel associated with the work of this section, including personnel to be in charge of the waste management program; members of the design team and the Owner.
2. Plan Revision: Make any revisions to the Construction Waste Management Plan agreed upon during the meeting and incorporate resolutions agreed to be made subsequent to the meeting. Submit the revised plan to architect for approval.

- D. Implementation: Designate an on-site party responsible for instructing workers and implementing the Construction Waste Management Plan. Distribute copies of the Construction Waste Management Plan to the job site foreman and each subcontractor. Include waste management and recycling in worker orientation. Provide on-site instruction on appropriate separation, handling, recycling, and salvaging methods to be used by all parties at the appropriate stages of the work at the site. Include waste management and recycling discussion in pre-fabrication meetings with subcontractors and fabricators. Also include discussion of waste management and recycling in regular job meetings and job safety meetings conducted during the course of work at the site.

#### 1.7 STORAGE AND HANDLING

- A. Site Storage: Remove all indicated recyclable materials from the work location to approved containers daily. Failure to remove waste materials will be considered cause for withholding payment and termination of Contract.

- B. Position covered containers for recyclable waste materials at a designated location on the Project Site. Select a location for the recyclable materials containers separated from that of general waste and rubbish containers. Provide separate collection containers for a minimum of the following materials unless the recycler accepts commingled material:

1. Untreated lumber.
2. Gypsum wallboard.
3. Paper, paper products, and cardboard.
4. Plastics.
5. Metals.
6. Glass.
7. Concrete
8. Other recyclable materials including Acoustical Ceiling Tiles and carpet.

- C. Change out loaded containers for empty containers as demand requires.

- D. Handling: Deposit all indicated recyclable materials in the containers in a clean (no mud, adhesives, solvents, petroleum contamination), debris-free condition. Do not deposit contaminated materials into the containers until such time as such materials have been cleaned.

- E. If the contamination chemically combines with the material so that it can not be cleaned, do not deposit into the recycle containers. In such case, request resolution by the Construction Quality Manager as to disposal of the contaminated material. Directions from the Construction Quality Manager do not relieve the Contractor from compliance with all legal and regulatory requirements for disposal, nor shall such directions cause a request for modification of the Contract.

#### 1.8 PROJECT/SITE CONDITIONS

- A. Environmental Requirements: Transport recyclable waste materials from the Work Area to the recycle containers and carefully deposit in the containers without excess noise and interference with other

activities, in a manner to minimize noise and dust. Reclose container covers immediately after materials are deposited.

1. Do not place recyclable waste materials on the ground adjacent to a container.

B. Existing Conditions: Coordinate with "Instructions to Bidders" and "Supplementary Conditions".

## PART 2 – PRODUCT (Not Used)

## PART 3 – EXECUTION

### 3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Source Separation: Separate, store, protect, and handle at the project site all identified recyclable and salvageable waste products to prevent contamination of materials and maximize recyclability and salvage ability of materials.

C. Arrange for the regular collection, transport from the site, and delivery to respective approved recycling centers of indicated recyclable waste materials. Maintain records accessible to the Contracting Officer's Representative for verification of construction waste materials recycling.

D. Delivery Receipts: Arrange for timely pickups from the site or deliveries to approved recycling facilities of designated waste materials to keep construction site clear and prevent contamination of recyclable materials. Keep and maintain records of all deliveries to recycling facilities and all pickups of waste materials at the site by others as specified above.

### 3.2 RECYCLABLE WASTE MATERIALS HANDLING

A. General: The following paragraphs supplement handling requirements for various of the materials identified for classification and recycling listed in Part 1 "Summary" article above.

B. Paper: Classify and handle waste paper goods as follows:

1. Bond Paper: As generally found in the construction offices and used for specifications, correspondence, copiers, PC laser printers and FAX machines. Collect in a separate container at each workstation and deposit loose in the appropriate recycle container daily.
2. Newsprint: Newspapers and tabloid style advertising (slick finish magazines and advertising materials are not typically recyclable). Collect in a single location and deposit daily in the appropriate recycle container.
3. Prints (drawings): Set up a single location for collection. Roll together to minimize space. Deposit daily in the appropriate recycle container.

C. Packaging materials:

1. Cardboard and paperboard cartons and boxes: Knock-down, fold flat and deposit in the appropriate recycle container.
2. Paper packing materials (separators, stiffeners, etc.) shall be placed in the same container.

3. Newsprint, used as packing (shredded or whole), shall be deposited in the recyclable container for newsprint.
4. Plastic (polystyrene peanuts and other shapes) shall be deposited in the recyclable container for plastics.
5. Metal and plastic banding materials shall be deposited in the appropriate container.

D. Metals: Cut all items to lengths and sizes to fit within the container provided, when necessary. Where there is sufficient quantity of a specific recyclable waste item (for example; salvaged metal roofing or duct work), make special arrangements for items to be bundled, banded or tied, and stack in a designated location for a special pick-up. Coordinate all special arrangements with the Construction Quality Manager.

E. Plastics: Collect recyclable plastics (polystyrene and others specifically marked for recycling) daily from work areas and deposit in designated containers.

F. Glass: Remove waste glass products (sheet, bottles, etc.) daily from the work area and deposit in designated containers. Where glass containers are marked for separation by color or type, segregate glass accordingly. Glass containing imbedded wire (typical in some fire rated doors having glazed lights) is usually not reprocessed; verify with the Construction Quality Manager that wire glass is not recyclable.

G. Gypsum board: Separate gypsum board from other wastes. Dispose of waste gypsum board off-site at a gypsum reclamation or recycling facility.

H. Acoustical Ceiling tile: Stack on used pallets and secure as recommended by Manufacturer. Contact Manufacturer for recycling.

I. Carpet: Roll up and secure as recommended by Manufacturer. Contact Manufacturer for recycling.

J. Other Items: Where recyclability classification of any given waste material is unclear, verify with the Construction Quality Manager.

### 3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials

END OF SECTION 017419



1 SECTION 017700 - CLOSEOUT PROCEDURES

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

- 4 A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and  
5 other Division 1 Specification Sections, apply to this Section.

6 1.2 SUMMARY

- 7 A. This Section includes administrative and procedural requirements for contract closeout, including, but not  
8 limited to, the following:

- 9 1. Substantial Completion procedures.  
10 2. Inspection procedures.  
11 3. Warranties.  
12 4. Final cleaning.

- 13 B. Related Requirements:

- 14 1. Section 017300 "Execution" for progress cleaning of Project site.  
15 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual  
16 requirements.  
17 3. Section 017839 "Project Record Documents" for submitting record Drawings, record  
18 Specifications, and record Product Data.  
19 4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

20 1.3 ACTION SUBMITTALS

- 21 A. Product Data: For cleaning agents.  
22 B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.  
23 C. Certified List of Incomplete Items: Final submittal at Final Completion.

24 1.4 CLOSEOUT SUBMITTALS

- 25 A. Certificates of Release: From authorities having jurisdiction.  
26 B. Certificate of Insurance: For continuing coverage.  
27 C. Field Report: For pest control inspection.

28 1.5 MAINTENANCE MATERIAL SUBMITTALS

- 29 A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other  
30 Sections

## 1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of seven (7) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
  - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
  5. Submit test/adjust/balance records.
  6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of seven (7) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  6. Advise Owner of changeover in heat and other utilities.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion

#### 1.7 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

- a. Project name.
- b. Date.
- c. Name of Architect.
- d. Name of Contractor.
- e. Page number.

4. Submit list of incomplete items in the following format:
  - a. PDF electronic file. Architect will return annotated file

#### 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

- 1 B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated  
2 portions of the Work that are completed and occupied or used by Owner during construction period by  
3 separate agreement with Contractor.
- 4 C. Organize warranty documents into an orderly sequence based on the table of contents of the Project  
5 Manual.
- 6 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as  
7 necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
- 8 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to  
9 identify the product or installation. Provide a typed description of the product or installation,  
10 including the name of the product and the name, address, and telephone number of Installer.
- 11 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES,"  
12 Project name, and name of Contractor.
- 13 D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## 14 PART 2 - PRODUCTS

### 15 2.1 MATERIALS

- 16 A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the  
17 surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or  
18 that might damage finished surfaces.
- 19 1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that  
20 comply with the California Code of Regulations maximum allowable VOC levels.

## 21 PART 3 - EXECUTION

### 22 3.1 FINAL CLEANING

- 23 A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local  
24 laws and ordinances and Federal and local environmental and antipollution regulations.
- 25 B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or  
26 unit to condition expected in an average parking garage cleaning and maintenance program. Comply  
27 with manufacturer's written instructions.
- 28 1. Complete the following cleaning operations before requesting inspection for certification of  
29 Substantial Completion for entire Project or for a portion of Project:
- 30 a. Clean Project site, yard, and grounds, in areas disturbed by construction activities,  
31 including landscape development areas, of rubbish, waste material, litter, and other foreign  
32 substances.
- 33 b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign  
34 deposits.
- 35 c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
- 36 d. Remove tools, construction equipment, machinery, and surplus material from Project site.
- 37 e. Remove snow and ice to provide safe access to building.

- 1 f. Clean exposed exterior hard-surfaced finishes to a dirt-free condition, free of stains, films,  
2 and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces.  
3 Restore reflective surfaces to their original condition.
- 4 g. Clean interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and  
5 similar foreign substances. Provide finish as specified in Division 2 through 16 Sections.
- 6 h. Remove debris and surface dust from limited access spaces, including roofs, plenums,  
7 shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- 8 i. Sweep concrete floors broom clean.
- 9 j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if  
10 visible soil or stains remain.
- 11 k. Clean transparent materials, including mirrors, and glass in doors and windows. Remove  
12 glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or  
13 broken glass and other damaged transparent materials. Polish mirrors and glass, taking  
14 care not to scratch surfaces.
- 15 l. Remove labels that are not permanent.
- 16 m. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace  
17 finishes and surfaces that cannot be satisfactorily repaired or restored or that already show  
18 evidence of repair or restoration. Do not paint over "UL" and similar labels, including  
19 mechanical and electrical nameplates.
- 20 n. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove  
21 excess lubrication, paint and mortar droppings, and other foreign substances.
- 22 o. Replace parts subject to unusual operating conditions.
- 23 p. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting  
24 from water exposure.
- 25 q. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of  
26 diffusers, registers, and grills.
- 27 r. Clean ducts, blowers, and coils if units were operated without filters during construction.
- 28 s. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace  
29 burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy  
30 starters in fluorescent and mercury vapor fixtures to comply with requirements for new  
31 fixtures.
- 32 t. Leave Project clean and ready for occupancy.
- 33 C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of  
34 rodents, insects, and other pests. Prepare a report.
- 35 D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess  
36 materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage  
37 systems. Remove waste materials from Project site and dispose of lawfully.

38 END OF SECTION 017700

1 SECTION 017823 - OPERATION AND MAINTENANCE DATA

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes administrative and procedural requirements for preparing operation and  
8 maintenance manuals, including the following:

- 9 1. Operation and maintenance documentation directory.  
10 2. Operation manuals for systems, subsystems, and equipment.  
11 3. Product maintenance manuals.  
12 4. Systems and equipment maintenance manuals.

- 13 B. Related Sections include the following:

- 14 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and  
15 maintenance manuals.  
16 2. Section 017700 "Closeout Procedures" for submitting operation and maintenance manuals.  
17 3. Section 017839 "Project Record Documents" for preparing Record Drawings for operation and  
18 maintenance manuals.

19 1.3 DEFINITIONS

- 20 A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

- 21 B. Subsystem: A portion of a system with characteristics similar to a system.

22 1.4 CLOSEOUT SUBMITTALS

- 23 A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in  
24 individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit  
25 reviewed manual content formatted and organized as required by this Section.

- 26 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.  
27 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field  
28 conditions.

- 29 B. Format: Submit operations and maintenance manuals in the following format:

- 30 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit  
31 on digital media acceptable to Architect.

- 32 a. Name each indexed document file in composite electronic index with applicable item  
33 name. Include a complete electronically linked operation and maintenance directory.  
34 b. Enable inserted reviewer comments on draft submittals.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or modify each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

#### 1.6 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

#### 1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

B. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

#### 1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.



3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate

references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.

4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.

2. Troubleshooting guide.

3. Precautions against improper maintenance.

4. Disassembly; component removal, repair, and replacement; and reassembly instructions.

5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation

#### 1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- 1 B. Content: Organize manual into a separate section for each product, material, and finish. Include source  
2 information, product information, maintenance procedures, repair materials and sources, and warranties  
3 and bonds, as described below.
- 4 C. Source Information: List each product included in manual, identified by product name and arranged to  
5 match manual's table of contents. For each product, list name, address, and telephone number of Installer  
6 or supplier and maintenance service agent, and cross-reference Specification Section number and title in  
7 Project Manual and drawing or schedule designation or identifier where applicable.
- 8 D. Product Information: Include the following, as applicable:
- 9 1. Product name and model number.  
10 2. Manufacturer's name.  
11 3. Color, pattern, and texture.  
12 4. Material and chemical composition.  
13 5. Reordering information for specially manufactured products.
- 14 E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
- 15 1. Inspection procedures.  
16 2. Types of cleaning agents to be used and methods of cleaning.  
17 3. List of cleaning agents and methods of cleaning detrimental to product.  
18 4. Schedule for routine cleaning and maintenance.  
19 5. Repair instructions.
- 20 F. Repair Materials and Sources: Include lists of materials and local sources of materials and related  
21 services.
- 22 G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions  
23 that would affect validity of warranties or bonds.
- 24 1. Include procedures to follow and required notifications for warranty claims.

25 PART 2 - PRODUCTS (Not Used)

26 PART 3 - EXECUTION (Not Used)

27 END OF SECTION 017823

1 SECTION 017839 - PROJECT RECORD DOCUMENTS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes administrative and procedural requirements for Project Record Documents,  
8 including the following:

- 9 1. Record Drawings.  
10 2. Record Specifications.  
11 3. Record Product Data.

- 12 B. Related Requirements:

- 13 1. Section 017300 "Execution" for final property survey.  
14 2. Section 017700 "Closeout Procedures" for general closeout procedures.  
15 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual  
16 requirements.

17 1.3 CLOSEOUT SUBMITTALS

- 18 A. Record Drawings: Submit PDF electronic files of scanned record prints.

- 19 B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including  
20 addenda and contract modifications.

- 21 C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

22 1.4 RECORD DRAWINGS

- 23 A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop  
24 Drawings, incorporating new and revised drawings as modifications are issued.

- 25 1. Preparation: Mark record prints to show the actual installation where installation varies from that  
26 shown originally. Require individual or entity who obtained record data, whether individual or  
27 entity is Installer, subcontractor, or similar entity, to provide information for preparation of  
28 corresponding marked-up record prints.

- 29 a. Give particular attention to information on concealed elements that would be difficult to  
30 identify or measure and record later.  
31 b. Accurately record information in an understandable drawing technique.  
32 c. Record data as soon as possible after obtaining it.  
33 d. Record and check the markup before enclosing concealed installations.  
34 e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

- a. Dimensional changes to Drawings.
- b. Revisions to details shown on Drawings.
- c. Depths of foundations below Basement and First Floor.
- d. Locations and depths of underground utilities.
- e. Revisions to routing of piping and conduits.
- f. Revisions to electrical circuitry.
- g. Actual equipment locations.
- h. Duct size and routing.
- i. Locations of concealed internal utilities.
- j. Changes made by Change Order or Construction Change Directive.
- k. Changes made following Architect's written orders.
- l. Details not on the original Contract Drawings.
- m. Field records for variable and concealed conditions.
- n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

- a. See Section 013100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Format: Annotated PDF electronic file with comment function enabled.
2. Identification: As follows:

- a. Project name.
- b. Date.
- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Architect.
- e. Name of Contractor.

## 1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
  5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

## 1.6 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, Record Drawings and Record Specifications where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.

## 1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

## 1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents and Samples: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

- 1 PART 2 - PRODUCTS
- 2 PART 3 - EXECUTION
- 3 END OF SECTION 017839

1 SECTION 017900 - DEMONSTRATION AND TRAINING

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes administrative and procedural requirements for instructing Owner's personnel,  
8 including the following:

- 9 1. Instruction in operation and maintenance of systems, subsystems, and equipment.  
10 2. Demonstration and training video recordings.

- 11 B. Related Requirements:

- 12 1. Section 013100 "Project Management and Coordination" for requirements for pre-instruction  
13 conferences.  
14 2. Divisions 02 through 49 Sections for specific requirements for demonstration and training for  
15 products in those Sections.

16 1.3 INFORMATIONAL SUBMITTALS

- 17 A. Instruction Program: Submit outline of instructional program for demonstration and training, including a  
18 list of training modules and a schedule of proposed dates, times, length of instruction time, and  
19 instructors' names for each training module. Include learning objective and outline for each training  
20 module.

- 21 1. Indicate proposed training modules utilizing manufacturer-produced demonstration and training  
22 video recordings for systems, equipment, and products in lieu of video recording of live  
23 instructional module.

- 24 B. Attendance Record: For each training module, submit list of participants and length of instruction time.

- 25 C. Evaluations: For each participant and for each training module, submit results and documentation of  
26 performance-based test.

27 1.4 QUALITY ASSURANCE

- 28 A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in  
29 Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and  
30 training.

- 31 B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section  
32 013100 "Project Management and Coordination." Review methods and procedures related to  
33 demonstration and training including, but not limited to, the following:



1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

#### 1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

#### 1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
  1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project Record Documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.
  3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.

- 1 c. Shutdown instructions for each type of emergency.
- 2 d. Operating instructions for conditions outside of normal operating limits.
- 3 e. Sequences for electric or electronic systems.
- 4 f. Special operating instructions and procedures.
- 5 4. Operations: Include the following, as applicable:
  - 6 a. Startup procedures.
  - 7 b. Equipment or system break-in procedures.
  - 8 c. Routine and normal operating instructions.
  - 9 d. Regulation and control procedures.
  - 10 e. Control sequences.
  - 11 f. Safety procedures.
  - 12 g. Instructions on stopping.
  - 13 h. Normal shutdown instructions.
  - 14 i. Operating procedures for emergencies.
  - 15 j. Operating procedures for system, subsystem, or equipment failure.
  - 16 k. Seasonal and weekend operating instructions.
  - 17 l. Required sequences for electric or electronic systems.
  - 18 m. Special operating instructions and procedures.
- 19 5. Adjustments: Include the following:
  - 20 a. Alignments.
  - 21 b. Checking adjustments.
  - 22 c. Noise and vibration adjustments.
  - 23 d. Economy and efficiency adjustments.
- 24 6. Troubleshooting: Include the following:
  - 25 a. Diagnostic instructions.
  - 26 b. Test and inspection procedures.
- 27 7. Maintenance: Include the following:
  - 28 a. Inspection procedures.
  - 29 b. Types of cleaning agents to be used and methods of cleaning.
  - 30 c. List of cleaning agents and methods of cleaning detrimental to product.
  - 31 d. Procedures for routine cleaning
  - 32 e. Procedures for preventive maintenance.
  - 33 f. Procedures for routine maintenance.
  - 34 g. Instruction on use of special tools.
- 35 8. Repairs: Include the following:
  - 36 a. Diagnosis instructions.
  - 37 b. Repair instructions.
  - 38 c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 39 d. Instructions for identifying parts and components.
  - 40 e. Review of spare parts needed for operation and maintenance.

## 1 1.7 PREPARATION

2 A. Assemble educational materials necessary for instruction, including documentation and training module.  
3 Assemble training modules into a training manual organized in coordination with requirements in  
4 Section 017823 "Operation and Maintenance Data."

5 B. Set up instructional equipment at instruction location.

## 6 1.8 INSTRUCTION

7 A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems,  
8 subsystems, and equipment not part of a system.

9 B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal  
10 operation, provide similar instruction at start of each season.

11 1. Schedule training with Owner with at least 7 days' advance notice.

12 C. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove  
13 instructional equipment. Restore systems and equipment to condition existing before initial training use.

## 14 PART 2 - PRODUCTS

## 15 PART 3 - EXECUTION

## 16 END OF SECTION 017900

1 SECTION 033000 - CAST-IN-PLACE CONCRETE

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

7 A. Section Includes:

- 8 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and  
9 finishes.  
10 2. Geofoam.

11 B. Related Requirements:

- 12 1. Section 033540 "Decorative Concrete Finishing" for concrete scheduled to be stamped and  
13 stained.  
14 2. Section 093300 "Staining and Transparent Finish" for concrete stain.  
15 3. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.  
16 4. Section 321313 "Concrete Curbs and Sidewalks" for concrete pavement and walks.

17 1.3 DEFINITIONS

- 18 A. Cementitious Materials: Portland cement alone or in combination with one or more of the following:  
19 blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to  
20 compliance with requirements.

- 21 B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

22 1.4 PREINSTALLATION MEETINGS

- 23 A. Preinstallation Conference: Conduct conference at Project site.

- 24 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend,  
25 including the following:

- 26 a. Contractor's superintendent.  
27 b. Independent testing agency responsible for concrete design mixtures.  
28 c. Ready-mix concrete manufacturer.  
29 d. Concrete Subcontractor.  
30 e. Special concrete finish Subcontractor.  
31

- 32 2. Review the following:

- 33 a. Special inspection and testing and inspecting agency procedures for field quality control.

- 1 b. Construction joints, control joints, isolation joints, and joint-filler strips.
- 2 c. Semirigid joint fillers.
- 3 d. Vapor-retarder installation.
- 4 e. Anchor rod and anchorage device installation tolerances.
- 5 f. Cold and hot weather concreting procedures.
- 6 g. Concrete finishes and finishing.
- 7 h. Curing procedures.
- 8 i. Forms and form-removal limitations.
- 9 j. Shoring and reshoring procedures.
- 10 k. Methods for achieving specified floor and slab flatness and levelness.
- 11 l. Floor and slab flatness and levelness measurements.
- 12 m. Concrete repair procedures.
- 13 n. Concrete protection.
- 14 o. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
- 15 p. Protection of field cured field test cylinders.

16 1.5 ACTION SUBMITTALS

17 A. Product Data: For each of the following.

- 18 1. Portland cement.
- 19 2. Fly ash.
- 20 3. Slag cement.
- 21 4. Blended hydraulic cement.
- 22 5. Performance-based hydraulic cement
- 23 6. Aggregates.
- 24 7. Admixtures:

25 a. Include limitations of use, including restrictions on cementitious materials, supplementary  
26 cementitious materials, air entrainment, aggregates, temperature at time of concrete  
27 placement, relative humidity at time of concrete placement, curing conditions, and use of  
28 other admixtures.

- 29 8. Color pigments.
- 30 9. Fiber reinforcement.
- 31 10. Vapor retarders.
- 32 11. Floor and slab treatments.
- 33 12. Liquid floor treatments.
- 34 13. Curing materials.

35 a. Include documentation from color pigment manufacturer, indicating that proposed methods  
36 of curing are recommended by color pigment manufacturer.

- 37 14. Joint fillers.
- 38 15. Repair materials.
- 39 16. Geofoam.

40 B. Design Mixtures: For each concrete mixture, include the following:

- 41 1. Mixture identification.
- 42 2. Minimum 28-day compressive strength.
- 43 3. Durability exposure class.
- 44 4. Maximum w/cm.
- 45 5. Calculated equilibrium unit weight, for lightweight concrete.
- 46 6. Slump limit.
- 47 7. Air content.

8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.
11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
13. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
14. Intended placement method.
15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - a. Location of construction joints is subject to approval of the Architect.
2. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
3. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
  - a. If mix water is to be withheld at the plant and later added at the Project site to provide the water to cement ratio of the design mix, this must be clearly indicated on EVERY delivery ticket to the Project site.
4. Geofoam: Drawings indicating size, type, proposed placement methods, location and orientation of Geofoam blocks, and type and location of connectors.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
  2. Admixtures.
  3. Fiber reinforcement.
  4. Curing compounds.
  5. Floor and slab treatments.
  6. Bonding agents.
  7. Adhesives.
  8. Vapor retarders.
  9. Semirigid joint filler.
  10. Joint-filler strips.
  11. Repair materials.
- 12 C. Material Test Reports: For the following, from a qualified testing agency:
- 13 1. Portland cement.
  - 14 2. Fly ash.
  - 15 3. Slag cement.
  - 16 4. Blended hydraulic cement.
  - 17 5. Performance-based hydraulic cement.
  - 18 6. Aggregates.
  - 19 7. Admixtures:
- 20 a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance
- 21 with specified requirements, including dosage rate used in test.
- 22 D. Floor surface flatness and levelness measurements report, indicating compliance with specified
- 23 tolerances.
- 24 E. Research Reports:
- 25 1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
  - 26 2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.
- 27 F. Preconstruction Test Reports: For each mix design.
- 28 G. Field quality-control reports.
- 29 H. Minutes of preinstallation conference.
- 30 1.7 QUALITY ASSURANCE
- 31 A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified
- 32 Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete
- 33 Finisher/Technician or an ACI Concrete Flatwork Technician.
- 34 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- 35 B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed
- 36 concrete products and that complies with ASTM C94/C94M requirements for production facilities and
- 37 equipment.
- 38 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete
- 39 Production Facilities."

- 1 C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077  
2 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control  
3 Technical Manager.
- 4 1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing  
5 Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory  
6 supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- 7 D. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities  
8 having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- 9 1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician,  
10 Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.
- 11 E. Mockups: Cast concrete panels to demonstrate typical joints, surface finish, color, texture, tolerances,  
12 floor treatments, and standard of workmanship.
- 13 1. Stained Concrete: Build panel approximately 8 feet by 8 feet in the location indicated or, if not  
14 indicated, as directed by Architect.
- 15 a. Divide panel into four equal panels to demonstrate saw joint cutting.

16 1.8 PRECONSTRUCTION TESTING

- 17 A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on  
18 each concrete mixture.
- 19 1. Include the following information in each test report:
- 20 a. Admixture dosage rates.  
21 b. Slump.  
22 c. Air content.  
23 d. Seven-day compressive strength.  
24 e. 28-day compressive strength.  
25 f. Permeability.

26 1.9 DELIVERY, STORAGE, AND HANDLING

- 27 A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).
- 28 B. Prevent damage to Geofoam during delivery, storage, and construction. Minimize exposure to sunlight  
29 and UV light. Protect from solvents, fuel, and open flames.

30 1.10 FIELD CONDITIONS

- 31 A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows.
- 32 1. Protect concrete work from physical damage or reduced strength that could be caused by frost,  
33 freezing actions, or low temperatures.
- 34 2. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three  
35 successive days, maintain delivered concrete mixture temperature within the temperature range  
36 required by ACI 301 (ACI 301M).
- 37 3. Do not use frozen materials or materials containing ice or snow.



4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Moisture Vapor Reduction Admixture (MVRA) Warranty shall include:

1. Term: Life of the concrete.
2. Repair and/or removal of failed flooring.
3. Placement of a topical remediation system.
4. Replacement of flooring materials like original installed to include material and labor.
5. Adhesion Warranty: Match the term of the adhesive manufacturer's warranty in accordance with the MVRA manufacturer's requirements for conveyance of such.

1.12 ENVIRONMENTAL REQUIREMENTS

A. Volatile Organic Compounds (VOCs): Comply with Pennsylvania's state and local VOC regulations for adhesives, sealants, paints, and coatings applied on site. Submit documentation showing compliance for each VOC-emitting material and product utilized in this Section.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

## B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, **Type I**.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

## C. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.

## 1. Alkali-Silica Reaction: Comply with one of the following:

- a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
- c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).

## 2. Maximum Coarse-Aggregate Size: 1 inch. 3/4 inch where placed by pump.

## 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

## D. Air-Entraining Admixture: ASTM C260/C260M.

## E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.

## a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Axim Italcementi Group, Inc.; CATEXOL CN-CI.
- 2) BASF Construction Chemicals - Building Systems; Rheocrete CNI.
- 3) Euclid Chemical Company (The), an RPM company; ARRMATECT.
- 4) Grace Construction Products, W. R. Grace & Co.; DCI.
- 5) Sika Corporation; Sika CNI.

## 6. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor, or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

## a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) BASF Construction Chemicals - Building Systems; Rheocrete 222+.
- 2) Cortec Corporation; MCI- [2000] [2005NS].
- 3) Grace Construction Products, W. R. Grace & Co.; DCI-S.

4) Sika Corporation; FerroGard 901.

7. Permeability-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, permeability-reducing crystalline admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).

a. Permeability: No leakage when tested in accordance with U.S. Army Corps of Engineers CRC C48 at a hydraulic pressure of 200 psi (1.28 MPa) for 14 days.

F. Moisture Vapor Reduction Admixture (MVRA):

1. Basis of Design Product: Barrier One High Performance Concrete Admixture by Barrier One, Inc., or equal as approved by the Architect before the Bid.

a. Approved Equal: Ise Logik 900.

2. For use at concrete slabs-on-grade only. ASTM C 494, Type S. Non-toxic, liquid admixture that is specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through the slab by restricting the integral capillary system.

3. Project specific quality control process shall include the following:

a. Independent procurement of one cylinder per day of placement of concrete containing MVRA; do not proceed without MVRA representative being present.

b. Independent testing of all cylinders for hydraulic conductivity per ASTM D5084.

c. Assessing each cylinder for maximum flow of 6.0 E-08 cm/sec.

d. Should any cylinder exceed the maximum flow, procure a core from that day's placement.

e. Independently test core for hydraulic conductivity per ASTM D5084.

f. Should any core exceed the maximum flow, provide a topical moisture mitigation system for all areas not meeting the stated limit; moisture mitigation system to include all labor, material and warranty that meets or exceeds the terms of the concrete moisture vapor reduction admixture manufacturer's warranty.

G. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

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

a. Stego Industries, LLC; Stego Wrap 15-mil Class A Vapor Barrier.

b. Barrier-Bac, Inc.; VB-350 16 mil Class A Vapor Retarder.

c. W. R. Meadows, Inc.; Sealtight Perminator 15 mil Class A Vapor Retarder.

d. Insulation Solutions Inc.; Viper VaporCheck II 15 mil Class A Vapor Barrier.

2.4 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1 B. Sealing Coat

2  
3 1. Basis-of-Design Product: Subject to compliance with requirements, provide Prosoco Concrete  
4 Protector or equal as approved by Architect in writing before the Bid.

5 a. Where discrepancies occur between the information contained in the Contract Drawings  
6 and the Specifications, submit discrepancies to the architect in writing for clarification  
7 before the Bid.

8 b. Approved Equals: Equivalent products by one of the following manufacturers:

- 9 1) H&C Concrete.  
10 2) Euclid Chemical.  
11 3) Sani-Tred.  
12 4) Sika Corporation.

13 2. All products submitted as equals by pre-approved manufacturers are subject to review by the  
14 Architect for verification that they are substantially equivalent to the Basis of Design products.

15 3. Named product specifications are used to establish the design, quality, sizes, functions, and  
16 accessories required for the Project. Subject to review and acceptance, minor variations in  
17 products by the other named manufacturers will be considered as long as other work is unaffected.

18 C. CURING MATERIALS

19 D. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh  
20 concrete.

21 E. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing  
22 approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

23 F. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

24 1. Color:

- 25 a. Ambient Temperature Below 50 deg F (10 deg C): Black.  
26 b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.  
27 c. Ambient Temperature Above 85 deg F (29 deg C): White.

28 G. Water: Potable.

29 H. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25  
30 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding  
31 of floor covering.

32 I. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

33 J. Products: Subject to compliance with requirements, products to include, but are not limited to, the  
34 following:

35 1. Evaporation Retarder:

- 36 a. Cimfilm; Axim Concrete Technologies.  
37 b. Finishing Aid Concentrate; Burke Group, LLC (The).  
38 c. Spray-Film; ChemMasters.  
39 d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.  
40 e. Sure Film; Dayton Superior Corporation.  
41 f. Eucobar; Euclid Chemical Co.

- g. Vapor Aid; Kaufman Products, Inc.
  - h. Lambco Skin; Lambert Corporation.
  - i. E-Con; L&M Construction Chemicals, Inc.
  - j. Confilm; Master Builders, Inc.
  - k. Waterhold; Metalcrete Industries.
  - l. Rich Film; Richmond Screw Anchor Co.
  - m. SikaFilm; Sika Corporation.
  - n. Finishing Aid; Symons Corporation.
  - o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.
2. Clear, Waterborne, Membrane-Forming Curing Compound:
- a. Anti-Hydro International, Inc.; AH Clear Cure WB.
  - b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
  - c. ChemMasters; Safe-Cure & Seal 20.
  - d. Conspec by Dayton Superior; Cure and Seal WB.
  - e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
  - f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
  - g. Edoco by Dayton Superior; Spartan Cote WB II.
  - h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
  - i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
  - j. Lambert Corporation; Glazecote Sealer-20.
  - k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
  - l. Meadows, W. R., Inc.; Vocomp-20.
  - m. Metalcrete Industries; Metcure.
  - n. Nox-Crete Products Group; Cure & Seal 150E.
  - o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
  - p. TK Products, Division of Sierra Corporation; TK-2519 WB.
  - q. Vexcon Chemicals, Inc.; Starseal 309.
3. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound:
- a. Klear-Kote Cure-Sealer-Hardener, 30 percent solids; Burke Group, LLC (The).
  - b. Polyseal WB; ChemMasters.
  - c. UV Safe Seal; Lambert Corporation.
  - d. Lumiseal WB Plus; L&M Construction Chemicals, Inc.
  - e. Vocomp-30; W. R. Meadows, Inc.
  - f. Metcure 30; Metalcrete Industries.
  - g. Vexcon Starseal 1315; Vexcon Chemicals, Inc.

## 2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, in accordance with ASTM D2240.
- C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.6 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested in accordance with ASTM C109/C109M.

## 2.7 GEOFOAM

A. Geofoam: Modified expanded polystyrene geo-synthetic fill material, ASTM D6817.

1. Basis of Design Product: Subject to compliance with requirements, provide InsulFoam GF, EPS22, as manufactured by InsulFoam LLC, or equal approved by architect in writing before the Bid.
2. Approved Products: Equivalent by the following manufacturers:
  - a. Atlas Molded Products.
  - b. ThermaFoam.
3. All products submitted as equals by pre-approved manufacturers are subject to review by the Architect for verification that they are substantially equivalent to the Basis of Design products.
4. Named product specifications are used to establish the design, quality, sizes, functions, and accessories required for the Project. Subject to review and acceptance, minor variations in products by the other named manufacturers will be considered as long as other work is unaffected.

B. Physical Properties:

1. Density: 1.35 lb./cu ft (21.6 kg/m).
2. Compressive Resistance: 7.3 psi @ 1% deformation.
3. Flexural Strength: 40 psi.
4. Elastic Modulus: 730 psi.
5. Oxygen Index, min., volume %: 24.0.

## 2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301 and ACI 318-02.
  2. Under circumstances where laboratory trial mix or field test data are not available, the required average compressive strength of concrete produced with materials similar to those specified shall be at least 1,200 psi greater than the specified compressive strength. This alternative shall not be permitted if the specified compressive strength is greater than 4,000 psi.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Concrete in Building Structures:
    - a. Fly Ash: 18 percent.
    - b. Ground Granulated Blast-Furnace Slag: 50 percent.
  2. Site Concrete:
    - a. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- D. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
1. Air Content: 6 percent for 3/4-inch nominal maximum aggregate size.
- E. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
- F. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- G. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

## 2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings, Piers and Foundation/Retaining Walls: Proportion normal-weight concrete mix as follows:
1. Minimum Compressive Strength (28 Days): 4000 psi, except 4500 psi where exposed to moisture and freeze thaw conditions.
  2. Maximum w/c ratio: 0.50.
  3. Maximum Slump: 4 inches.
  4. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2-to-4-inch slump.

B. Interior Slabs-on-Grade: Proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength (28 Days): 3500 psi.
2. Select cementitious materials content from subparagraphs below or delete if ACI 301 default for floors is sufficient. ACI 302.1R recommends quantities in listed order below, for nominal maximum aggregate sizes 1-1/2, 1, and 3/4 inch (38, 25, and 19 mm). ACI 301 sets identical quantities, but for minimum cement rather than cementitious materials content.
3. Minimum Cementitious Materials Content: 520 lb./cu. yd.
4. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8-inches after admixture is added to concrete .
5. Interior slab mix is to contain a high-range, water-reducing admixture with a water cement ratio equal to 0.47.
6. Produce a mix that has the minimum amount of water necessary to generate a 2-to-3-inch slump prior to the addition of any water reducing admixtures, as recommended in ACI 302.1R, "Concrete Floor and Slab Construction", Chapter 6, "Concrete Properties and Consistency".
7. Reinforce concrete with polypropylene fiber reinforcement at a dosage rate specified by fiber reinforcement manufacturer. Reinforcement to be placed in concrete at the mixing plant per fiber reinforcement manufacturer's recommendations. Welded wire fabric is permitted in lieu of polypropylene fiber reinforcement, in accordance with the Drawings.
8. Per ACI 544.3, mix designs for concrete containing fiber reinforcement shall include a maximum 55% by volume coarse aggregate content by total volume of aggregates (sand and stone).

C. Slabs on Metal Deck: Proportion normal-weight concrete mix as follows:

1. Minimum Compressive Strength (28 Days): 3500 psi.
2. Minimum Cementitious Materials Content: 520 lb./cu. yd.
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8-inches after admixture is added to concrete .
4. Interior slab mix is to contain a high-range, water-reducing admixture with a water cement ratio equal to 0.47.
5. Produce a mix that has the minimum amount of water necessary to generate a 2-to-3-inch slump prior to the addition of any water reducing admixtures, as recommended in ACI 302.1R, "Concrete Floor and Slab Construction", Chapter 6, "Concrete Properties and Consistency"
6. Reinforce concrete with welded wire fabric per contract documents and supported per Paragraph 3.5.E. The use of polypropylene fiber reinforcement is not allowed to replace welded wire fabric.

2.10 CONCRETE MIXTURES FOR SITE ELEMENTS

A. Class A: Normal-weight concrete used for footings, walk-off pads, grade beams, and tie beams.

1. Minimum Compressive Strength: 5000 psi at 28 days.
2. Maximum w/c ratio: 0.45.
3. Slump Limit: 4 inches plus or minus 1 inch.
4. Slump Flow Limit: 22 inches, plus or minus 1.5 inches.
5. Air Content:
  - a. Exposure Classes F2 and F3: 5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch nominal maximum aggregate size.

2.11 FABRICATING REINFORCEMENT

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



## 2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116 and furnish batch ticket information for EACH delivery to the Project site.

1. When air temperature is between 85 and 90 deg. F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd., or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

## 3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

#### 3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

- a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

#### 3.5 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

- a. Continue reinforcement across construction joints unless otherwise indicated.
- b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
  2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints:
1. Install dowel bars and support assemblies at joints where indicated on Drawings.
  2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.
- 3.6 CONCRETE PLACEMENT
- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
  2. Deposit concrete to avoid segregation.
  3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).
  - a. Do not use vibrators to transport concrete inside forms.
  - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
  - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
  - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

### 3.7 FINISHING FORMED SURFACES

#### A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
  - a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
  - b. Remove projections larger than 1 inch (25 mm).
  - c. Tie holes do not require patching.
  - d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
  - e. Apply to concrete surfaces not exposed to public view.
2. ACI 301 (ACI 301M) Surface Finish SF-3.0:
  - a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
  - b. Remove projections larger than 1/8 inch (3 mm).
  - c. Patch tie holes.
  - d. Surface Tolerance: ACI 117 (ACI 117M) Class A.
  - a. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

#### B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

##### 1. Smooth-Rubbed Finish:

- a. Perform no later than one day after form removal.
- b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
- c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.

- d. Maintain required patterns or variances as shown on Drawings or to match design reference sample, field sample panels, or mockups.
2. Grout-Cleaned Rubbed Finish:
  - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
  - b. Do not clean concrete surfaces as Work progresses.
  - c. Mix 1-part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
  - d. Wet concrete surfaces.
  - e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
  - f. Maintain required patterns or variances as shown on Drawings or to match design reference sample, field sample panels, or mockups.
3. Cork-Floated Finish:
  - a. Mix 1-part portland cement to 1-part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
  - b. Mix 1-part portland cement and 1-part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
  - c. Wet concrete surfaces.
  - d. Compress grout into voids by grinding surface.
  - e. In a swirling motion, finish surface with a cork float.
  - f. Maintain required patterns or variances as shown on Drawings or to match design reference sample, field sample panels, or mockups.
4. Scrubbed Finish: After concrete has achieved a compressive strength of from 1000 to 1500 psi (6.9 to 10.3 MPa), apply scrubbed finish.
  - a. Wet concrete surfaces thoroughly and scrub with stiff fiber or wire brushes, using water freely, until top mortar surface is removed, and aggregate is uniformly exposed.
  - b. Rinse scrubbed surfaces with clean water.
  - c. Maintain continuity of finish on each surface or area of Work.
  - d. Remove only enough concrete mortar from surfaces to match design reference sample, field sample panels, or mockups.
- C. Abrasive-Blast Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
  1. Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi (13.8 MPa).
  2. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at the same age.
  3. Surface Continuity:
    - a. Perform abrasive-blast finishing as continuous operation, maintaining continuity of finish on each surface or area of Work.
    - b. Maintain required patterns or variances in depths of blast to match design reference sample, field sample panels, or mockups.
  4. Abrasive Blasting:
    - a. Abrasive-blast corners and edges of patterns carefully, using backup boards to maintain uniform corner and edge lines.

- b. Determine type of nozzle pressure and blasting techniques required to match field sample.
  - c. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces to match field sample, as follows:
    - 1) Brush Texture: Remove cement matrix to dull surface sheen and expose face of fine aggregate, with no significant reveal.
    - 2) Light Texture: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color, with maximum reveal of 1/16 inch (1.5 mm).
    - 3) Medium Texture: Generally, expose coarse aggregate with slight reveal and with a maximum reveal of 1/4 inch (6 mm).
    - 4) Heavy Texture: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter, with reveal range of 1/4 to 1/2 inch (6 to 13 mm).
  - d. Maintain required patterns or variances in reveal projection to match design reference sample, field sample panels, or mockups.
- D. High-Pressure Water-Jet Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
1. Perform high-pressure water jetting on concrete that has achieved a minimum compressive strength of 4500 psi (31 MPa).
  2. Coordinate with formwork removal to ensure that surfaces to be high-pressure waterjet finished are treated at same age for uniform results.
  3. Surface Continuity: Perform high-pressure water-jet finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.
  4. Maintain required patterns or variances in reveal projection to match design reference sample, field sample panels, or mockups.
- E. Bushhammer Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
1. Perform bushhammer finish to concrete that has achieved a minimum compressive strength of 4500 psi (31 MPa).
  2. Surface Continuity:
    - a. Perform bushhammer finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.
  3. Surface Cut:
    - a. Maintain required depth of cut and general aggregate exposure.
    - b. Use power tool with hammer attachments for large, flat surfaces, and use hand hammers for small areas, at corners and edges, and for restricted locations where power tools cannot reach.
  4. Remove impressions of formwork and form facings with exception of tie holes.
  5. Maintain required patterns or variances of cut as shown on Drawings or to match design reference sample, field sample panels, or mockups.
  6. Maintain control of concrete chips, dust, and debris in each Work area, limiting migration of airborne materials and dust by use of tarpaulins, windbreaks, or similar devices.
- F. Related Unformed Surfaces:
1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
  2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

## 3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings and surfaces to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155 (ASTM E1155M), for a randomly trafficked floor surface:

a. Slabs on Ground:

- 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3 mm).
- 2) Specified overall values of flatness,  $F_F$  25; and of levelness,  $F_L$  20; with minimum local values of flatness,  $F_F$  17; and of levelness,  $F_L$  15.
- 3) For Areas with Thin Floor Coverings: Specified overall values of flatness,  $F_F$  35; and of levelness,  $F_L$  25; with minimum local values of flatness,  $F_F$  24; and of levelness,  $F_L$  17.

b. Suspended Slabs:

- 1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3 mm).
- 2) Specified overall values of flatness,  $F_F$  25; and of levelness,  $F_L$  20; with minimum local values of flatness,  $F_F$  17; and of levelness,  $F_L$  15.

- 3) For Areas with Thin Floor Coverings: Specified overall values of flatness,  $F_F$  35; and of levelness,  $F_L$  25; with minimum local values of flatness,  $F_F$  24; and of levelness,  $F_L$  17.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings or where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
1. Coordinate required final finish with Architect before application.
  2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
  2. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps as indicated on Drawings
1. Apply in accordance with manufacturer's written instructions and as follows:
    - a. Tamp aggregate flush with surface, but do not force below surface.
    - b. After broadcasting and tamping, apply float finish.
    - c. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

### 3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

#### A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

#### B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

#### C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 8 inches high unless otherwise indicated on Drawings and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 5000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place, and secure anchorage devices.
  - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.



- b. Cast anchor-bolt insert into bases.
- c. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

- 1. Cast-in inserts and accessories, as shown on Drawings.
- 2. Screed, tamp, and trowel finish concrete surfaces.

### 3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

- 1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
- 2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
- 3. Maintain moisture loss no more than 0.2 lb./sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1,) before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

- 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
- 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
- 3. If forms remain during curing period, moist cure after loosening forms.
- 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
  - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
  - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
  - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
  - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
  - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
    - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
    - 2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

- 1. Begin curing immediately after finishing concrete.
- 2. Interior Concrete Floors:
  - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
    - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
      - a) Lap edges and ends of absorptive cover not less than 12-inches (300-mm).

- 1 b) Maintain absorptive cover water saturated, and in place, for duration of  
2 curing period, but not less than seven days.
- 3 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining  
4 cover for curing concrete, placed in widest practicable width, with sides and ends  
5 lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
- 6 a) Immediately repair any holes or tears during curing period, using cover  
7 material and waterproof tape.  
8 b) Cure for not less than seven days.
- 9 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces  
10 continuously wet for not less than seven days, utilizing one, or a combination of, the  
11 following:
- 12 a) Water.  
13 b) Continuous water-fog spray.
- 14 b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the  
15 following:
- 16 1) Absorptive Cover: As soon as concrete has sufficient set to permit application  
17 without marring concrete surface, install prewetted absorptive cover over entire area  
18 of floor.
- 19 a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).  
20 b) Maintain absorptive cover water saturated, and in place, for duration of  
21 curing period, but not less than seven days.
- 22 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining  
23 cover for curing concrete, placed in widest practicable width, with sides and ends  
24 lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
- 25 a) Immediately repair any holes or tears during curing period, using cover  
26 material and waterproof tape.  
27 b) Cure for not less than seven days.
- 28 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces  
29 continuously wet for not less than seven days, utilizing one, or a combination of, the  
30 following:
- 31 a) Water.  
32 b) Continuous water-fog spray.
- 33 c. Floors to Receive Polished Finish: Contractor has option of the following:
- 34 1) Absorptive Cover: As soon as concrete has sufficient set to permit application  
35 without marring concrete surface, install prewetted absorptive cover over entire area  
36 of floor.
- 37 a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).  
38 b) Maintain absorptive cover water saturated, and in place, for duration of  
39 curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

- a) Water.
- b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
- 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
- 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
- 4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
- 2) Rewet absorptive cover and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches (150 mm) and sealed in place.
- 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
- 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

a. Floors to Receive Curing Compound:

- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Maintain continuity of coating, and repair damage during curing period.
- 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

b. Floors to Receive Curing and Sealing Compound:

- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

### 3.11 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

### 3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than **seven** days' old or unless manufacturer certifies treatment will not interfere with bonding of floor covering used on Project.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.

- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

### 3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s).
2. Do not fill joints until construction traffic has permanently ceased.

- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints.

- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

### 3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1-part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling, and placing.

- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.

- a. Limit cut depth to 3/4 inch (19 mm).
- b. Make edges of cuts perpendicular to concrete surface.
- c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
- d. Fill and compact with patching mortar before bonding agent has dried.
- e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

- a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    - b. Compact mortar in place and strike off slightly higher than surrounding surface.
  3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces:
  1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
    - a. Correct low and high areas.
    - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  3. After concrete has cured at least 14 days, correct high areas by grinding.
  4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
    - a. Finish repaired areas to blend into adjacent concrete.
  5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
    - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    - b. Feather edges to match adjacent floor elevations.
  6. Correct other low areas scheduled to remain exposed with repair topping.
    - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations.
    - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  7. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete.
    - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around.
    - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    - d. Place, compact, and finish to blend with adjacent finished concrete.
    - e. Cure in same manner as adjacent concrete.
  8. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.
    - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    - b. Dampen cleaned concrete surfaces and apply bonding agent.
    - c. Place patching mortar before bonding agent has dried.
    - d. Compact patching mortar and finish to match adjacent concrete.

- 1 e. Keep patched area continuously moist for at least 72 hours.
- 2 E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching  
3 mortar.
- 4 F. Repair materials and installation not specified above may be used, subject to Architect's approval.
- 5 3.15 FIELD QUALITY CONTROL
- 6 A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and  
7 prepare testing and inspection reports.
- 8 1. Testing by Owner: Limited to testing as indicated in Section 01 40 00 "Quality Control  
9 Requirements". All other testing is the responsibility of the Contractor.
- 10 B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to  
11 submit reports.
- 12 1. Testing agency shall be responsible for providing curing container for composite samples on Site  
13 and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
- 14 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any  
15 failure of Work to comply with Contract Documents.
- 16 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect,  
17 Contractor, and concrete manufacturer within 48 hours of inspections and tests.
- 18 a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M,  
19 and ACI 301, including the following as applicable to each test and inspection:
- 20 1) Project name.
- 21 2) Name of testing agency.
- 22 3) Names and certification numbers of field and laboratory technicians performing  
23 inspections and testing.
- 24 4) Name of concrete manufacturer.
- 25 5) Date and time of inspection, sampling, and field testing.
- 26 6) Date and time of concrete placement.
- 27 7) Location in Work of concrete represented by samples.
- 28 8) Date and time sample was obtained.
- 29 9) Truck and batch ticket numbers.
- 30 10) Design compressive strength at 28 days.
- 31 11) Concrete mixture designation, proportions, and materials.
- 32 12) Field test results.
- 33 13) Information on storage and curing of samples before testing, including curing  
34 method and maximum and minimum temperatures during initial curing period.
- 35 14) Type of fracture and compressive break strengths at seven days and 28 days.
- 36 C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency,  
37 indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content,  
38 design slump at time of batching, and amount of water that can be added at Project site.
- 39 D. Inspections:
- 40 1. Steel reinforcement placement.
- 41 2. Steel reinforcement welding .
- 42 3. Headed bolts and studs.
- 43 4. Verification of use of required design mixture.
- 44 5. Concrete placement, including conveying and depositing.

6. Curing procedures and maintenance of curing temperature.
  7. Verification of concrete strength before removal of shores and forms from beams and slabs.
  8. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C143/C143M:
    - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    - b. Perform additional tests when concrete consistency appears to change.
  3. Slump Flow: ASTM C1611/C1611M:
    - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    - b. Perform additional tests when concrete consistency appears to change.
  4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete.
    - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  5. Concrete Temperature: ASTM C1064/C1064M:
    - a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
  6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
    - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  7. Compression Test Specimens: ASTM C31/C31M:
    - a. Cast and laboratory cure two sets of standard cylinder specimens for each composite sample.
    - b. Cast, initial cure, and field cure two sets of standard cylinder specimens for each composite sample.
  8. Compressive-Strength Tests: ASTM C39/C39M.
    - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
    - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.

- c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:
- a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
- 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

### 3.16 INSTALLATION OF GEOFOAM

- A. Install geofoam according to manufacturer's written instructions.
- B. Geofoam fill shall be placed to the lines and grades shown in the plans and as directed by the engineer. The surface of a layer of Geofoam blocks to receive additional Geofoam blocks shall be constructed with a variation in surface tolerance of no more than 15 mm (0.05 feet) in any 3 m (10 ft) interval. All blocks shall accurately fit relative to adjacent blocks. No gaps greater than 20 mm (0.07ft) will be allowed on vertical joints.
- C. The finished surface of the Geofoam immediately beneath pavement sections shall be constructed to within the tolerance of zero to minus 60 mm (0.20 ft) of the indicated grade.
- D. Blocks placed in a row in a particular layer shall be offset .6 m (2.0 ft) relative to blocks placed in adjacent rows of the same layer as shown on the plans. In order to avoid continuous joints, each subsequent layer of blocks shall be rotated on the horizontal plane 90 degrees from the direction of placement of the previous layer placed.
- E. Blocks shall be cut using a hot wire.



- F. It is the Contractor's responsibility to provide temporary weighting and/or guying as necessary until all the blocks are built into a homogeneous mass, and the pavement section as well as any soil cover are in place.

3.17 PROTECTION

- A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

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1 SECTION 042200 - CONCRETE UNIT MASONRY

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Concrete masonry units.
- 6 2. Decorative (ground face) concrete masonry units.
- 7 3. Decorative (split face) concrete masonry units.
- 8 4. Mortar and grout.
- 9 5. Steel reinforcing bars.
- 10 6. Masonry-joint reinforcement.
- 11 7. Embedded flashing.
- 12 8. Miscellaneous masonry accessories.

13 B. Products Installed but not Furnished under This Section:

- 14 1. Cast-stone trim in concrete unit masonry

15 1.2 DEFINITIONS

16 A. CMU(s): Concrete masonry unit(s).

17 B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

18 1.3 ACTION SUBMITTALS

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

20 B. Shop Drawings: For the following:

- 21 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
- 22 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars.
- 23 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

25 C. Samples for Initial Selection:

- 26 1. Decorative CMUs, in the form of small-scale units.
- 27 2. Colored mortar.

28 D. Samples for Verification: For each type and color of the following:

- 29 1. Decorative CMUs.
- 30 2. Exposed mortar. Make Samples using same sand and mortar ingredients to be used on Project.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements.
    - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
  2. Integral water repellant used in CMUs.
  3. Cementitious materials. Include name of manufacturer, brand name, and type.
  4. Mortar admixtures.
  5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  6. Grout mixes. Include description of type and proportions of ingredients.
  7. Reinforcing bars.
  8. Joint reinforcement.
  9. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
  2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build decorative CMU as part of exterior wall mockup specified in Section 044318 "Adhered Thin Stone Veneer" including face and backup wythes and accessories.
    - a. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
  2. Protect accepted mockups from the elements with weather-resistant membrane.
  3. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

- a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
- b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

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

#### 1.7 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
  1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

### 2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet (6 m) vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

### 2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed decorative CMUs.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent

manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

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

- 1) ACM Chemistries.
- 2) BASF Construction Chemicals, LLC.
- 3) Grace Construction Products; W.R. Grace & Co. -- Conn.

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less-than-nominal dimensions.

D. Concrete Building Brick: ASTM C 55.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 4050 psi (27.92 MPa).
2. Density Classification: Normal weight.

E. Ground Face Decorative CMUs (DCMU – 3): ASTM C 90.

1. Characteristics: Same strength, weight and type as standard concrete masonry units, except as otherwise indicated.
2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
3. Finish: Integrally colored exposed faces with ground finish on faces indicated to expose special colored aggregates.
4. Colors and Patterns: As selected by Architect from full range of industry options.
  - a. Basis of Design:
    - 1) (DCMU – 3) Ground Face Accent CMU: Nitterhouse - NM-122

F. Split-Face Decorative CMUs: ASTM C 90.

1. Characteristics: Same strength, weight and type as standard concrete masonry units, except as otherwise indicated.
2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
3. Finish: Integrally colored exposed faces with split-face finish on faces indicated to expose special colored aggregates.
4. Colors and Patterns: As selected by Architect from full range of industry options.
  - a. Basis of Design:
    - 1) (DCMU – 1) Primary light colored Decorative CMU: Nitterhouse – NM-122
    - 2) (DCMU – 2) Primary dark colored accent Decorative CMU: Nitterhouse – NM-135

G. Special Units for Reinforced CMU: Provide in locations indicated, to control location of horizontal and vertical reinforcing. Comply with requirements indicated for concrete masonry units and the following:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Ivany Block; as patented by George R. Ivany Assoc., Inc., and produced by authorized Ivany Block licensee.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3500 psi.
3. Weight Classification: Normal weight.

## 2.5 CONCRETE AND MASONRY LINTELS

- A. General: For exposed conditions, provide masonry lintels complying with requirements below. For concealed conditions, provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.
- B. Concrete Lintels: ASTM C 1623, matching CMUs in density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.
- C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

## 2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Davis Colors; True Tone Mortar Colors.
- b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
- c. Solomon Colors, Inc.; SGS Mortar Colors.
- E. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
- a. Products: Subject to compliance with requirements, provide one of the following:
- 1) Essroc; Riverton Portland Cement Lime Custom Color.
- 2) Holcim (US) Inc; Rainbow Mortamix Custom Color Cement/Lime.
- 3) Lafarge North America Inc.; Eaglebond Portland & Lime.
- 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
- F. Aggregate for Mortar: ASTM C 144.



1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C 404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

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

- a. Euclid Chemical Company (The); Accelguard 80.
- b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
- c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

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

- a. ACM Chemistries; RainBloc for Mortar.
- b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
- c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

J. Water: Potable.

## 2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

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

- a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
- b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
- c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
- d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.

1. Material: Hot-dip galvanized carbon steel.
2. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
3. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
4. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
5. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

## 2.8 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into masonry but with at least a 5/8-inch (16-mm) cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
  2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
  3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.
  2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.
- D. Partition Top Anchors: 0.105-inch- (2.66-mm-) thick metal plate with a 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

## 2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide stainless-steel flashing complying with Section 076200 "Sheet Metal Flashing and Trim" and as follows:
1. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
  2. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond.
- a. Products: Subject to compliance with requirements, provide one of the following:
- 1) Cheney Flashing Company; Cheney 3-Way Flashing (Sawtooth) or Cheney Flashing (Dovetail).
  - 2) Keystone Flashing Company, Inc; Keystone 3-Way Interlocking Thruwall Flashing.
3. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
  4. Fabricate metal drip edges for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches (76 mm) into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
  5. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
  6. Solder metal items at corners.
- B. Flexible Flashing: Use the following unless otherwise indicated:

1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040 inch (1.02 mm) thick.

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

- 1) Carlisle Coatings & Waterproofing Inc; Pre-Kleened EPDM Thru-Wall Flashing.
- 2) Firestone Specialty Products; FlashGuard.
- 3) Heckmann Building Products, Inc.; No. 81 EPDM Thru-Wall Flashing.
- 4) Hohmann & Barnard, Inc; Epra-Max EPDM Thru-Wall Flashing.

- C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

- D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

## 2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

- D. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch (9-mm) OD by 4 inches (100 mm) long.

## 2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match sample approved by Architect.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

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

#### 3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

## 3.3 TOLERANCES

## A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

## B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm).

## C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

## 3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
1. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
  2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  3. Bed webs in mortar in grouted masonry, including starting course on footings.
  4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.
- E. For masonry walls to receive fluid-applied air barriers, fill mortar joints fully and cut flush with face of masonry units. Provide masonry surfaces that are smooth and free from projections.
1. Fill voids and holes, including those at mortar joints, with lean mortar mix or non-shrink grout, or provide smooth-troweled parge coat over entire surface of masonry.
    - a. For parging, use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm).
    - b. Damp-cure parging for at least 24 hours and protect parging until cured.

## 3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

## 3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) wide between masonry and structural steel unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

## 3.8 CONTROL JOINTS

A. General: Install control-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry by installing preformed control-joint gaskets designed to fit standard sash block.

## 3.9 LINTELS

A. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

## 3.10 FLASHING AND WEEP HOLES

A. General: Install embedded flashing and weep holes at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
4. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep hole product to form weep holes.
2. Space weep holes 16 inches (400 mm) o.c.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.



- 1 C. Testing Prior to Construction: One set of tests.
- 2 D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- 3 E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive  
4 strength.
- 5 F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to  
6 ASTM C 780.
- 7 G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- 8 H. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

9 3.13 REPAIRING, POINTING, AND CLEANING

- 10 A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that  
11 do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to  
12 eliminate evidence of replacement.
- 13 B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill  
14 with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat,  
15 uniform appearance. Prepare joints for sealant application, where indicated.
- 16 C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and  
17 smears before tooling joints.
- 18 D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
- 19 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or  
20 chisels.
- 21 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison  
22 purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of  
23 masonry.
- 24 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with  
25 liquid strippable masking agent or polyethylene film and waterproof masking tape.
- 26 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing  
27 surfaces thoroughly with clear water.
- 28 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

29 END OF SECTION 042200

## 1 SECTION 047200 - CAST STONE MASONRY

## 2 PART 1 - GENERAL

## 3 1.1 RELATED DOCUMENTS

- 4 A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and  
5 Division 1 Specification Sections, apply to this Section.

## 6 1.2 SUMMARY

- 7 A. This Section includes the following:

- 8 1. Cast stone trim, including the following:

- 9 a. Window sills.  
10 b. Coping.

## 11 1.3 DEFINITIONS

- 12 A. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.

## 13 1.4 SUBMITTALS

- 14 A. Product Data: Include construction details, material descriptions, dimensions of individual components  
15 and profiles, and finishes for cast stone units.

- 16 B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions,  
17 details of reinforcement and anchorages if any, and indication of finished faces.

- 18 1. Include building elevations showing layout of units and locations of joints and anchors.

- 19 C. Samples for Initial Selection: For colored mortar.

- 20 D. Samples for Verification:

- 21 1. For each color and texture of cast stone required, 10 inches square in size.  
22 2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on  
23 Project. Label Samples to indicated types and amounts of pigments used.

- 24 E. Mockup Samples: Furnish sample units as indicated on Drawings for installation in mockups.

- 25 F. Full-Size Samples: For each type of cast stone unit required.

- 26 1. Make available for Architect's review at Project site.  
27 2. Make Samples from materials to be used for units used on Project immediately before beginning  
28 production of units for Project.  
29 3. Approved Samples may be installed in the Work.

- 30 G. Qualification Data: For manufacturer and testing agency.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

H. Quality-Control Plan: Manufacturer's written quality-control plan that includes all elements of the Cast Stone Institute's "Quality Control Procedures Required for Plant Inspection."

1. Provide copies of documentation showing compliance with quality-control plan as requested by Architect.

I. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.

#### 1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, with sufficient production capacity to manufacture required units.

1. Manufacturer is a producing member of the Cast Stone Institute.

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations for Cast Stone: Obtain cast stone units through one source from a single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to minimize the need for on-site storage and to avoid delaying the Work.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store installation materials on elevated platforms, under cover, and in a dry location.

- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

## 1.7 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but not less than 7 days after completing cleaning.

- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 CAST STONE MATERIALS

- A. General: Comply with ASTM C 1364 and the following:

- B. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures and colors as needed to produce required cast stone colors.

- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation as needed to produce required textures and colors as needed to produce required cast stone colors.

- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.

- F. Admixtures: Do not use admixtures unless specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.

3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

### 2.3 CAST STONE UNITS

A. Available Manufacturers:

1. American Art Stone Inc.
2. Continental Cast Stone Manufacturing, Inc.
3. Sun Precast Co., Inc.

B. Provide cast stone units complying with ASTM C 1364 using the manufacturer's selected method.

1. Trim units including window sills and copings as indicated on Drawings.
2. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

C. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12, unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements, unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure units by one of the following methods:

1. Cure units with steam in enclosed curing room at temperature of 105 deg F or above and 95 to 100 percent relative humidity for 6 hours.
2. Cure units with dense fog and water spray in enclosed warm curing room at 95 to 100 percent relative humidity for 24 hours.
3. Cure units to comply with one of the following:

- 1 a. Not less than 5 days at mean daily temperature of 70 deg F or above.
- 2 b. Not less than 6 days at mean daily temperature of 60 deg F or above.
- 3 c. Not less than 7 days at mean daily temperature of 50 deg F or above.
- 4 d. Not less than 8 days at mean daily temperature of 45 deg F or above.

5 F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

6 G. Colors and Textures: As selected by Architect from manufacturer's full range.

## 7 2.4 MORTAR MATERIALS

8 A. Provide mortar materials that comply with Division 4 Section "Unit Masonry Assemblies."

## 9 2.5 ACCESSORIES

10 A. Anchors: Type and size indicated, fabricated from stainless steel complying with ASTM A 240/A 240M,  
11 ASTM A 276, or ASTM A 666, Type 304.

12 B. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, and 1/2-inch diameter.

## 13 2.6 MORTAR MIXES

14 A. Comply with requirements in Division 4 Section "Unit Masonry Assemblies" for mortar mixes.

## 15 2.7 SOURCE QUALITY CONTROL

16 A. Employ an independent testing agency to sample and test cast stone units according to ASTM C 1364.

17 1. Include one test for resistance to freezing and thawing.

18

## 19 PART 3 - EXECUTION

### 20 3.1 EXAMINATION

21 A. Examine substrates and conditions, with Installer present, for compliance with requirements for  
22 installation tolerances and other conditions affecting performance of cast stone.

23 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 24 3.2 SETTING CAST STONE IN MORTAR

25 A. Install cast stone units to comply with requirements in Division 4 Section "Unit Masonry Assemblies."

26 B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces  
27 aligned according to established relationships and indicated tolerances.

28 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in  
29 place.

- 1 C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
- 2 D. Set units in full bed of mortar with full head joints, unless otherwise indicated.
- 3 1. If not indicated, set units with joints 1/4 to 3/8 inch wide.
- 4 2. Build anchors and ties into mortar joints as units are set.
- 5 3. Fill dowel holes and anchor slots with mortar.
- 6 4. Fill collar joints solid as units are set.
- 7 5. Build concealed flashing into mortar joints as units are set.
- 8 6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive
- 9 sealant.
- 10 7. Keep joints at shelf angles open to receive sealant.
- 11 E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness,
- 12 unless otherwise indicated.
- 13 F. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated. Keep joints
- 14 free of mortar and other rigid materials.
- 15 1. Form open joint of width indicated, but not less than 3/8 inch.
- 16 G. Prepare joints indicated to receive sealant and apply sealant of type and at locations indicated to comply
- 17 with applicable requirements in Division 7 Section "Joint Sealants."
- 18 1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before
- 19 applying sealant, unless otherwise indicated.
- 20 3.3 ADJUSTING AND CLEANING
- 21 A. Remove and replace stained and otherwise damaged units and units not matching approved Samples.
- 22 Cast stone may be repaired if methods and results are approved by Architect.
- 23 B. Replace units in a manner that results in cast stone matching approved Samples, complying with other
- 24 requirements, and showing no evidence of replacement.
- 25 END OF SECTION 04720

## 1 SECTION 051200 - STRUCTURAL STEEL FRAMING

## 2 PART 1 - GENERAL

## 3 1.1 RELATED DOCUMENTS

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

## 6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Structural steel.  
9 2. Shrinkage-resistant grout.

- 10 B. Related Requirements:

- 11 1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.  
12 2. Section 055000 "Metal Fabrications" for [steel lintels and shelf angles not attached to structural-  
13 steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.  
14 ~~3.~~ Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"

## 15 1.3 DEFINITIONS

- 16 A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in  
17 ANSI/AISC 303.

## 18 1.4 COORDINATION

- 19 A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and  
20 coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible  
21 with one another.

- 22 B. Coordinate installation of anchorage items to be embedded in or attached to other construction without  
23 delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for  
24 installation.

## 25 1.5 PREINSTALLATION MEETINGS

- 26 A. Preinstallation Conference: Conduct conference at Project site.

## 27 1.6 ACTION SUBMITTALS

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

- 29 B. Shop Drawings: Show fabrication of structural-steel components.



1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  2. Include embedment Drawings.
  3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
  2. Electrode manufacturer and trade name, for demand-critical welds.
- D. Samples for Initial Selection: For products involving selection of color, texture, or design.
- E. Delegated-Design Submittal: For all structural-steel connections, including but not limited to shear connection, moment connections, splice connections, to comply with design loads indicated on Drawings, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation and licensed in the appropriate state.

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Product Test Reports: For the following:
1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
  2. Direct-tension indicators.
  3. Tension-control, high-strength, bolt-nut-washer assemblies.
  4. Shear stud connectors.
  5. Nonshrink grout.
  6. Structural steel including chemical and physical properties.
- F. Source quality-control reports.
- G. Field quality-control reports and special inspection reports.

#### 1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant.
- B. Installer Qualifications: A qualified installer that participates in the AISC Quality Program OR has 5 or more years of experience in similar sized projects.

1 C. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint or to SSPC-QP 3.

2 D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

3 1.9 DELIVERY, STORAGE, AND HANDLING

4 A. Store materials to permit easy access for inspection and identification. Keep steel members off ground  
5 and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged  
6 materials from corrosion and deterioration.

7 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to  
8 members or supporting structures. Repair or replace damaged materials or structures as directed.

9 B. Store materials out of direct sunlight or insulate to ensure that beams and other members do not expand in  
10 the heat prior to be welded to bearing walls. Expanded beams that contract after installation can cause  
11 damage to the masonry walls local to the bearing plates. Such damage will require repair at no additional  
12 cost to the owner.

13 C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

14 1. Fasteners may be repackaged provided testing and inspecting agency observes repackaging and  
15 seals containers.

16 2. Clean and relubricate bolts and nuts that become dry or rusty before use.

17 3. Comply with manufacturers' written recommendations for cleaning and lubricating  
18 ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after  
19 lubrication.

20 PART 2 - PRODUCTS

21 2.1 PERFORMANCE REQUIREMENTS

22 A. Comply with applicable provisions of the following specifications and documents:

23 1. ANSI/AISC 303.

24 2. ANSI/AISC 341.

25 3. ANSI/AISC 360.

26 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

27 B. Connection Design Information:

28 1. Design connections and final configuration of member reinforcement at connections in accordance  
29 with ANSI/AISC 303 by fabricator's qualified professional engineer.

30 a. Use Allowable Stress Design; data are given at service-load level.

31 C. Moment Connections Type FR, fully restrained.

32 D. Construction: Combined system of moment frame and shear walls.

33 2.2 STRUCTURAL-STEEL MATERIALS

34 A. W-Shapes: ASTM A992/A992M.

- 1 B. Channels, Angles: ASTM A36/A36M.
- 2 C. Plate and Bar: ASTM A36/A36M or ASTM A572/A572M, Grade 50 (345) as required for connection  
3 design or where indicated.
- 4 D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.
- 5 E. Welding Electrodes: Comply with AWS requirements.
- 6 F. Finish: Provide powder coating finish where indicated on the Drawings.
- 7 2.3 BOLTS AND CONNECTORS
- 8 A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M),  
9 Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex  
10 carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- 11 1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer  
12 type with plain finish.
- 13 B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852,  
14 Type 1, round head assemblies, consisting of steel structural bolts with splined ends; ASTM A563,  
15 Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1,  
16 hardened carbon-steel washers.
- 17 1. Finish: Plain.
- 18 C. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished  
19 carbon steel; AWS D1.1/D1.1M, Type B.
- 20 2.4 RODS
- 21 A. Unheaded Anchor Rods: ASTM F1554, Grade 36
- 22 1. Configuration: Straight.
- 23 2. Nuts: ASTM A563 (ASTM A563M) heavy hex carbon steel.
- 24 3. Plate Washers: ASTM A36/A36M carbon steel.
- 25 4. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
- 26 5. Finish: Plain or Hot-dip zinc coating, ASTM A153/A153M, Class C for exterior exposed columns.
- 27 B. Threaded Rods: ASTM A36/A36M
- 28 1. Nuts: ASTM A 63 (ASTM A563M) hex carbon steel.
- 29 2. Washers: ASTM F436 (ASTM F436M), Type 1, hardened
- 30 3. Finish: Plain
- 31 2.5 PRIMER
- 32 A. Steel Primer:
- 33 1. SSPC-Paint 23, latex primer.
- 34 2. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with  
35 MPI#79 and compatible with topcoat.

- 1 B. Galvanized-Steel Primer: MPI#26
- 2 1. Etching Cleaner: MPI#25, for galvanized steel.
- 3 2. Galvanizing Repair Paint: ASTM A780/A780M.
- 4 2.6 SHRINKAGE-RESISTANT GROUT
- 5 A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic
- 6 aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application
- 7 and a 30-minute working time.
- 8 2.7 POWDER COATING
- 9 A. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil,
- 10 grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from
- 11 uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-
- 12 SP 8, "Pickling."
- 13 B. Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating.
- 14 C. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard
- 15 thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5
- 16 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
- 17 1. Color and Gloss: As selected by Architect from manufacturer's full range.
- 18 2.8 FABRICATION
- 19 A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with
- 20 ANSI/AISC 303 and to ANSI/AISC 360.
- 21 1. Camber structural-steel members where indicated.
- 22 2. Fabricate beams with rolling camber up.
- 23 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings
- 24 until structural-steel framing has been erected.
- 25 4. Mark and match-mark materials for field assembly.
- 26 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming
- 27 operations.
- 28 B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
- 29 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- 30 C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- 31 D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- 32 E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 3.
- 33 F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors.
- 34 Weld using automatic end welding of headed-stud shear connectors in accordance with
- 35 AWS D1.1/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.9 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

## 2.10 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
3. Galvanize all exterior columns including all base connection material and anchor rods.
4. Galvanize all steel exposed to exterior conditions.

## 2.11 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.
6. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

## 2.12 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

B. Testing by Owner is limited to testing as indicated in Section 01 40 00 "Quality Control Requirements". All other testing is the responsibility of the Contractor.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
  - a. Liquid Penetrant Inspection: ASTM E165/E165M.
  - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
  - c. Ultrasonic Inspection: ASTM E164.
  - d. Radiographic Inspection: ASTM E94/E94M.
4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
  - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
5. Prepare test and inspection reports.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
1. Do not remove temporary shoring supporting structural-steel framing until cast-in-place concrete has attained its design compressive strength.

#### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

- 1 B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-  
2 reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
- 3 1. Set plates for structural members on wedges, shims, or setting nuts as required.  
4 2. Weld plate washers to top of baseplate.  
5 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not  
6 remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with  
7 grout.  
8 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids  
9 remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with  
10 manufacturer's written installation instructions for grouting.
- 11 C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- 12 D. Align and adjust various members that form part of complete frame or structure before permanently  
13 fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with  
14 members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- 15 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated  
16 on Drawings.  
17 2. Make allowances for difference between temperature at time of erection and mean temperature  
18 when structure is completed and in service.
- 19 E. Splice members only where indicated.
- 20 F. **Do not** use thermal cutting during erection unless approved by Architect. Finish thermally cut sections  
21 within smoothness limits in AWS D1.1/D1.1M.
- 22 G. **Do not** enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged  
23 to admit bolts.

### 24 3.4 FIELD CONNECTIONS

- 25 A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural  
26 Joints Using High-Strength Bolts" for bolt and joint type specified.
- 27 1. Joint Type: Snug tightened or Pretensioned
- 28 B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances,  
29 welding procedure specifications, weld quality, and methods used in correcting welding work.
- 30 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of  
31 temporary connections, and removal of paint on surfaces adjacent to field welds.  
32 2. Remove backing bars or runoff tabs where indicated or exposed to view, back gouge, and grind  
33 steel smooth.  
34 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without  
35 exceeding tolerances in ANSI/AISC 303 for mill material.

### 36 3.5 FIELD QUALITY CONTROL

- 37 A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
- 38 1. Verify structural-steel materials and inspect steel frame joint details.  
39 2. Verify weld materials and inspect welds.

3. Verify connection materials and inspect high-strength bolted connections.
- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  1. Testing by Owner: Limited to testing as indicated in Section 01 40 00 "Quality Control Requirements". All other testing is the responsibility of the Contractor.
  2. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  3. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
    - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
      - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      - 3) Ultrasonic Inspection: ASTM E164.
      - 4) Radiographic Inspection: ASTM E94/E94M.

### 3.6 CLEANING, REPAIR AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- D. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."
- E. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 051200



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1 SECTION 052100 - STEEL JOIST FRAMING

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. K-series steel joists.  
9 2. KCS-type K-series steel joists.  
10 3. K-series steel joist substitutes.  
11 4. Joist accessories.

- 12 B. Related Requirements:

- 13 1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.  
14 2. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.  
15 3. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

16 1.3 DEFINITIONS

- 17 A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for  
18 Steel Joists and Joist Girders."

- 19 B. Special Joists: Steel joists requiring modification by manufacturer to support non-uniform, unequal, or  
20 special loading conditions that invalidate load tables in SJI's "Specifications."

21 1.4 ACTION SUBMITTALS

- 22 A. Product Data: For each type of joist, accessory, and product.

- 23 B. Shop Drawings:

- 24 1. Include layout, designation, number, type, location, and spacing of joists.  
25 2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and  
26 connection locations and details; and attachments to other construction.  
27 3. Indicate locations and details of bearing plates to be embedded in other construction.

28 1.5 INFORMATIONAL SUBMITTALS

- 29 A. Qualification Data: For manufacturer

- 30 B. Welding certificates.

- 1 C. Manufacturer certificates.
- 2 D. Mill Certificates: For each type of bolt.
- 3 E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional
- 4 engineer responsible for its preparation.
- 5 F. Field quality-control reports.

## 6 1.6 QUALITY ASSURANCE

- 7 A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with
- 8 applicable standard specifications and load tables in SJI's "Specifications." and "Standard Specification
- 9 for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight
- 10 Tables and Bridging Tables, Code of Standard Practice."

- 11 1. Manufacturer's responsibilities include providing professional engineering services for designing
- 12 special joists to comply with performance requirements.

- 13 B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M,
- 14 "Structural Welding Code - Steel."

## 15 1.7 DELIVERY, STORAGE, AND HANDLING

- 16 A. Deliver, store, and handle joists as recommended in SJI's "Specifications." and "Standard Specification
- 17 for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight
- 18 Tables and Bridging Tables, Code of Standard Practice."

- 19 B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

## 20 1.8 SEQUENCING

- 21 A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

## 22 PART 2 - PRODUCTS

### 23 2.1 PERFORMANCE REQUIREMENTS

- 24 A. Structural Performance: Provide special joists and connections capable of withstanding design loads
- 25 indicated.

- 26 1. Use ASD; data are given at service-load level
- 27 2. Design special joists to withstand design loads with live-load deflections no greater than the
- 28 following:

- 29 a. Floor Joists: Vertical deflection of 1/360 of the span.
- 30 b. Roof Joists: Vertical deflection of 1/360 of the span.

## 2.2 K-SERIES STEEL JOISTS

- A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
1. Joist Type: K-series steel joists and KCS-type K-series steel joists.
- B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
- C. Provide holes in chord members for connecting and securing other construction to joists.
- D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."
- E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."
- F. Camber joists according to SJI's "Specifications."
- G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

## 2.3 PRIMERS

- A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
- B. Primer: Provide shop primer that complies with Section 099123 "Interior Painting." where exposed to view.

## 2.4 JOIST ACCESSORIES

- A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications. Furnish additional erection or uplift bridging if required for stability.
- C. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated.
- D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated.
1. Finish: Plain, uncoated.
- E. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

- 1            1.     Finish: Plain.
- 2            F.     Welding Electrodes: Comply with AWS standards.
- 3            G.     Galvanizing Repair Paint: ASTM A780/A780M.
- 4            H.     Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to  
5            complete joist assembly.
- 6    2.5     CLEANING AND SHOP PAINTING
- 7            A.     Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and  
8            accessories by hand-tool cleaning, SSPC-SP 2.
- 9            B.     Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- 10          C.     Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry  
11          paint film not less than 1 mil (0.025 mm) thick.
- 12          D.     Shop priming of joists and joist accessories is specified in and Section 099123 "Interior Painting."
- 13    PART 3 - EXECUTION
- 14    3.1     EXAMINATION
- 15          A.     Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance  
16          with requirements for installation tolerances and other conditions affecting performance of the Work.
- 17          B.     Proceed with installation only after unsatisfactory conditions have been corrected.
- 18    3.2     INSTALLATION
- 19          A.     Do not install joists until supporting construction is in place and secured.
- 20          B.     Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction  
21          according to SJI's Specifications joist manufacturer's written instructions, and requirements in this  
22          Section.
- 23            1.     Before installation, splice joists delivered to Project site in more than one piece.
- 24            2.     Space, adjust, and align joists accurately in location before permanently fastening.
- 25            3.     Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are  
26            stabilized during construction.
- 27            4.     Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are  
28            applied. See drawings for joists to be used in moment frames.
- 29          C.     Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and  
30          procedure with placement of joists. Comply with AWS requirements and procedures for welding,  
31          appearance and quality of welds, and methods used in correcting welding work.
- 32          D.     Bolt joists to supporting steel framework only as required using carbon-steel bolts.

- 1 E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's  
2 "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts" for high-strength structural  
3 bolt installation and tightening requirements.
- 4 F. Install and connect bridging concurrently with joist erection before construction loads are applied.  
5 Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

6 3.3 FIELD QUALITY CONTROL

- 7 A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- 8 B. Visually inspect field welds according to AWS D1.1/D1.1M.
- 9 1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following  
10 procedures, at testing agency's option:
- 11 a. Liquid Penetrant Inspection: ASTM E165/E165M.  
12 b. Magnetic Particle Inspection: ASTM E709.  
13 c. Ultrasonic Testing: ASTM E164.  
14 d. Radiographic Testing: ASTM E94.
- 15 C. Visually inspect bolted connections.
- 16 D. Prepare test and inspection reports.

17 3.4 PROTECTION

- 18 A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to  
19 ASTM A780/A780M and manufacturer's written instructions.
- 20 B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections,  
21 rust spots, and abraded surfaces of prime-painted joists, **abutting structural steel** and accessories.
- 22 1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning  
23 according to SSPC-SP 3.  
24 2. Apply a compatible primer of same type as primer used on adjacent surfaces.
- 25 C. Touchup Painting: Cleaning and touchup painting are specified in [Section 099113 "Exterior Painting"  
26 and Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

27 END OF SECTION 052100

## 1 SECTION 053100 - STEEL DECKING

## 2 PART 1 - GENERAL

## 3 1.1 RELATED DOCUMENTS

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

## 6 1.2 SUMMARY

## 7 A. Section Includes:

- 8 1. Roof deck.  
9 2. Composite floor deck.

## 10 B. Related Requirements:

- 11 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural  
12 concrete fill over steel deck.  
13 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear  
14 connectors.  
15 3. Section 055000 "Metal Fabrications" for framing deck openings with  
16 miscellaneous steel shapes.  
17 4. Section 099113 "Exterior Painting" for repair painting of primed deck and finish  
18 painting of deck.  
19 5. Section 099123 "Interior Painting" for repair painting of primed deck and finish  
20 painting of deck.

## 21 1.3 ACTION SUBMITTALS

- 22 A. Product Data: For each type of deck, accessory, and product indicated.

## 23 B. Shop Drawings:

- 24 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans,  
25 cut deck openings, special jointing, accessories, and attachments to other construction.

## 26 1.4 INFORMATIONAL SUBMITTALS

- 27 A. Welding certificates.

- 28 B. Product Certificates: For each type of steel deck.

- 29 C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of  
30 the following complies with requirements:

- 31 1. Power-actuated mechanical fasteners.  
32 2. Acoustical roof deck.

1 D. Evaluation Reports: For steel deck, from ICC-ES.

2 E. Field quality-control reports.

3 1.5 QUALITY ASSURANCE

4 A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

5 B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M,  
6 "Structural Welding Code - Sheet Steel."

7 C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval  
8 Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

9 1.6 DELIVERY, STORAGE, AND HANDLING

10 A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and  
11 handling.

12 B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof  
13 covering and ventilate to avoid condensation.

14 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to  
15 maintain insulation free of moisture.

16 PART 2 - PRODUCTS

17 2.1 PERFORMANCE REQUIREMENTS

18 A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to  
19 AISI's "North American Specification for the Design of Cold-Formed Steel Structural  
20 Members."

21 B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency.  
22 Identify products with appropriate markings of applicable testing agency.

23 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of  
24 another qualified testing agency.

25 2.2 ROOF DECK

26 A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI  
27 Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the  
28 following:

29 1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 50, G60  
30 (Z180)] zinc coating.

31 2. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS),  
32 Grade 50, G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's  
33 standard baked-on, rust-inhibitive primer.



- 1                   a.   Color: Manufacturer's standard Gray
- 2                   3.   Deck Profile: As indicated Retain one option in "Profile Depth" Subparagraph below or
- 3                   revise to suit Project. Indicate locations on Drawings if various depths are required. FM
- 4                   Global approval, if required, is limited to roof deck 1-1/2 inches (38 mm) deep.
- 5                   4.   Profile Depth: As indicated
- 6                   5.   Design Uncoated-Steel Thickness: As indicated
- 7                   6.   Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated
- 8                   7.   Span Condition: As indicated
- 9                   8.   Side Laps: Overlapped.
- 10   2.3       COMPOSITE FLOOR DECK
- 11           A.   Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and
- 12           interlocking side laps, to comply with "SDI Specifications and Commentary for Composite
- 13           Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated,
- 14           and with the following:
- 15               1.   Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 50
- 16               minimum, with top surface phosphatized and unpainted and underside surface shop
- 17               primed with manufacturers' standard gray baked-on, rust-inhibitive primer.
- 18               2.   Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 50, G60
- 19               (Z180) zinc coating.
- 20               3.   Profile Depth: As indicated.
- 21               4.   Design Uncoated-Steel Thickness: As indicated.
- 22               5.   Span Condition: Triple span.
- 23   2.4       ACCESSORIES
- 24           A.   General: Provide manufacturer's standard accessory materials for deck that comply with
- 25           requirements indicated.
- 26           B.   Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically
- 27           driven carbon-steel fasteners; or self-drilling, self-threading screws.
- 28           C.   Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel
- 29           screws, No. 10 (4.8-mm) minimum diameter.
- 30           D.   Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- 31           E.   Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 50,000
- 32           psi, not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish
- 33           as deck; of profile indicated or required for application.
- 34           F.   Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 50,000 psi, of same
- 35           material and finish as deck, and of thickness and profile recommended by SDI Publication
- 36           No. 31 for overhang and slab depth.
- 37           G.   Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material,
- 38           finish, and thickness as deck unless otherwise indicated.
- 39           H.   Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

- 1 I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and  
2 finish as deck. For drains, cut holes in the field.
- 3 J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material  
4 and finish as deck, with 3-inch- (76-mm-) wide flanges and level recessed pans of 1-1/2-inch  
5 (38-mm) minimum depth. For drains, cut holes in the field.
- 6 K. Galvanizing Repair Paint: ASTM A780/A780M.
- 7 L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

8 PART 3 - EXECUTION

9 3.1 EXAMINATION

- 10 A. Examine supporting frame and field conditions for compliance with requirements for  
11 installation tolerances and other conditions affecting performance of the Work.
- 12 B. Proceed with installation only after unsatisfactory conditions have been corrected.

13 3.2 INSTALLATION, GENERAL

- 14 A. Install deck panels and accessories according to applicable specifications and commentary in  
15 SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- 16 B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- 17 C. Locate deck bundles to prevent overloading of supporting members.
- 18 D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned  
19 and bearing on supporting frame before being permanently fastened. Do not stretch or contract  
20 side-lap interlocks.
- 21 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting  
22 panels.
- 23 E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- 24 F. Cut and neatly fit deck panels and accessories around openings and other work projecting  
25 through or adjacent to deck.
- 26 G. Provide additional reinforcement and closure pieces at openings as required for strength,  
27 continuity of deck, and support of other work.
- 28 H. Comply with AWS requirements and procedures for manual shielded metal arc welding,  
29 appearance and quality of welds, and methods used for correcting welding work.
- 30 I. Mechanical fasteners may be used in lieu of welding to fasten deck with Architect's approval.  
31 Locate mechanical fasteners and install according to deck manufacturer's written instructions.

## 3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
1. Weld Diameter: 5/8 inch, nominal.
  2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart, unless noted otherwise.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (914 mm), and as follows:
1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
  2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.
1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.
- G. Sound-Absorbing Insulation: Installation into topside ribs of deck per manufacturer's recommendations.

## 3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
1. Weld Diameter: 5/8 inch, nominal.
  2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart, unless note otherwise.

- 1 B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels  
2 between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches (914  
3 mm), and as follows:
- 4 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel  
5 screws.  
6 2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- 7 C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2  
8 inches (38 mm), with end joints as follows:
- 9 1. End Joints: Lapped or butted at Contractor's option.
- 10 D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting  
11 structure according to SDI recommendations unless otherwise indicated.
- 12 E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck,  
13 according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and  
14 sides of deck.
- 15 F. Install piercing hanger tabs at 14 inches (355 mm) apart in both directions, within 9 inches (228  
16 mm) of walls at ends, and not more than 12 inches (305 mm) from walls at sides unless  
17 otherwise indicated.

18 3.5 FIELD QUALITY CONTROL

- 19 A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.  
20 B. Field welds will be subject to inspection.  
21 C. Prepare test and inspection reports.  
22 D. Remove and replace work that does not comply with specified requirements.  
23 E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of  
24 corrected work with specified requirements.

25 3.6 PROTECTION

- 26 A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck  
27 with galvanized repair paint according to ASTM A780/A780M and manufacturer's written  
28 instructions.
- 29 B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of  
30 prime-painted deck immediately after installation and apply repair paint.
- 31 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of  
32 deck exposed to view.  
33 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in  
34 Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- 35 C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded  
36 areas of both deck surfaces are included in Section 099113 "Exterior Painting" and  
37 Section 099123 "Interior Painting."

- 1                    D.     Provide final protection and maintain conditions to ensure that steel deck is without damage or
- 2                               deterioration at time of Substantial Completion.
  
- 3     END OF SECTION 053100

1 SECTION 054000 - COLD-FORMED METAL FRAMING

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:  
8 1. Exterior non-load-bearing wall framing.  
9 2. Interior non-load-bearing wall framing.  
10 3. Soffit framing.
- 11 B. Related Requirements:  
12 1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and  
13 connections used with cold-formed metal framing.  
14 2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-  
15 stud framing, with height limitations and ceiling-suspension assemblies.

16 1.3 PREINSTALLATION MEETINGS

- 17 A. Preinstallation Conference: Conduct conference at Project site

18 1.4 ACTION SUBMITTALS

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

- 20 B. Shop Drawings:

- 21 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication;  
22 and fastening and anchorage details, including mechanical fasteners.  
23 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing,  
24 bridging, splices, accessories, connection details, and attachment to adjoining work.

- 25 C. Delegated-Design Submittal: For cold-formed steel framing, include structural analysis data signed and  
26 seals by the qualified professional engineer responsible for their preparation.

27 1.5 INFORMATIONAL SUBMITTALS

- 28 A. Qualification Data: For testing agency.

- 29 B. Welding certificates.

- 30 C. Product Certificates: For each type of code-compliance certification for studs and tracks.

- 1 D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a  
2 qualified testing agency a qualified testing agency.

- 3 1. Steel sheet.
- 4 2. Expansion anchors.
- 5 3. Power-actuated anchors.
- 6 4. Mechanical fasteners.
- 7 5. Vertical deflection clips.
- 8 6. Horizontal drift deflection clips
- 9 7. Miscellaneous structural clips and accessories.

## 10 1.6 QUALITY ASSURANCE

- 11 A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- 12 B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing  
13 with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal  
14 thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating  
15 thickness.
- 16 C. Welding Qualifications: Qualify procedures and personnel according to the following:
- 17 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 18 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- 19 D. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and  
20 Two Family Dwellings."

## 21 PART 2 - PRODUCTS

### 22 2.1 MANUFACTURERS

- 23 A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:  
24
- 25 1. ClarkDietrich Building Systems.
  - 26 2. Marino\WARE.
  - 27 3. Nuconsteel, A Nucor Company.
  - 28 4. Steel Network, Inc. (The).
  - 29 5. Steel Structural Systems.
  - 30 6. United Steel Deck, Inc.

### 31 2.2 PERFORMANCE REQUIREMENTS

- 32 A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality  
33 Requirements," to design cold-formed steel framing.
- 34 B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within  
35 limits and under conditions indicated.
- 36 1. Design Loads: As indicated on Drawings or as calculated per code.
  - 37 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater  
38 than the following:

- 1 a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 typical of the wall
- 2 height and 1/600 of the wall height where supporting veneer.
- 3 b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height
- 4 under a horizontal load of 5 lbf/sq. ft. (239 Pa).
- 5 e. Soffit Joist Framing: Vertical deflection of 1/360 for wind loads and 1/240 for total loads of
- 6 the span.
- 7 3. Design framing systems to provide for movement of framing members located outside the
- 8 insulated building envelope without damage or overstressing, sheathing failure, connection failure,
- 9 undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum
- 10 ambient temperature change of 120 deg F (67 deg C).
- 11 4. Design framing system to maintain clearances at openings, to allow for construction tolerances,
- 12 and to accommodate live load deflection of primary building structure as follows:
- 13 a. Upward and downward movement of 1 inch (25 mm) unless noted otherwise on structural
- 14 drawings.
- 15 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without
- 16 regard for contribution of sheathing materials.
- 17 C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall
- 18 comply with AISI S100, AISI S200, and the following:
- 19 1. Floor and Roof Systems: AISI S210.
- 20 2. Wall Studs: AISI S211.
- 21 3. Headers: AISI S212.
- 22 D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify
- 23 products with appropriate markings of applicable testing agency.
- 24 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another
- 25 qualified testing agency acceptable to authorities having jurisdiction.

## 2.3 COLD-FORMED STEEL FRAMING MATERIALS

- 27 A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating
- 28 designation as follows:
- 29 1. Grade: As required by structural performance.
- 30 2. Coating: G60 (Z180).
- 31 B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of
- 32 grade and coating as follows:
- 33 1. Grade: As required by structural performance.
- 34 2. Coating: G90 (Z275).

## 2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- 36 A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with
- 37 stiffened flanges, and as follows:
- 38 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
- 39 2. Flange Width: 1-3/8 inches (35 mm) minimum.



- 1 B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with  
2 unstiffened flanges, and as follows:
- 3 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).  
4 2. Flange Width: 1-1/4 inches (32 mm).
- 5 C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and  
6 downward vertical displacement of primary structure through positive mechanical attachment to stud  
7 web.
- 8 D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with  
9 unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges  
10 designed to support horizontal loads and transfer them to the primary structure, and as follows:
- 11 1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).  
12 2. Flange Width: Minimum of 2½" inch or 1 inch (25 mm) plus the design deflection given on the  
13 drawings.
- 14 E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested  
15 inner and outer tracks; unpunched, with unstiffened flanges.
- 16 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed  
17 to support horizontal loads and transfer them to the primary structure, and as follows:
- 18 a. Minimum Base-Metal Thickness 0.0538 inch (1.37 mm).  
19 b. Flange Width: Minimum of 2½" inch or 1 inch (25 mm) plus the design deflection given  
20 on the drawings.
- 21 2. Inner Track: Of web depth indicated, and as follows:
- 22 a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).  
23 b. Flange Width: dimension equal to sum of outer deflection track flange width plus 1 inch,  
24 minimum.
- 25 F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and  
26 downward vertical displacement and lateral drift of primary structure through positive mechanical  
27 attachment to stud web and structure.
- 28 G. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and  
29 downward vertical displacement of primary structure through positive mechanical attachment to stud  
30 web.

31 2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

- 32 A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with  
33 stiffened flanges, and as follows:
- 34 1. Minimum Base-Metal Thickness: 0.0538 inch minimum.  
35 2. Flange Width: 1-5/8 inches.
- 36 B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with  
37 unstiffened flanges, and as follows:
- 38 1. Minimum Base-Metal Thickness: Matching steel studs.  
39 2. Flange Width: 1-1/4 inches.

- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
  2. Flange Width: 1 inch.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0538 inch.
    - b. Flange Width: 1 inch plus the design gap.
  2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0538 inch.
    - b. Flange Width: equal to sum of outer deflection track flange width plus 1 inch.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.6 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
  2. Flange Width: 1-5/8 inches (41 mm), minimum.

## 2.7 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
  2. Bracing, bridging, and solid blocking.
  3. Web stiffeners.
  4. Anchor clips.
  5. End clips.
  6. Gusset plates.
  7. Stud kickers and knee braces.
  8. Hole-reinforcing plates.
  9. Backer plates.

## 2.8 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, and as appropriate for the substrate.
1. Uses: Securing cold-formed steel framing to structure.
  2. Type: Torque-controlled expansion anchor or adhesive anchor.
  3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

## 2.9 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

## 2.10 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate framing assemblies using jigs or templates.
  2. Cut framing members by sawing or shearing; do not torch cut.
  3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

- 1 a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and  
2 quality of welds, and methods used in correcting welding work.
- 3 b. Locate mechanical fasteners and install according to Shop Drawings, with screws  
4 penetrating joined members by no fewer than three exposed screw threads.
- 5 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening,  
6 or screw fastening, according to Shop Drawings.
- 7 B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses.  
8 Lift fabricated assemblies by means that prevent damage or permanent distortion.
- 9 C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8  
10 inch in 10 feet (1:960) and as follows:
- 11 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from  
12 plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or  
13 other finishing materials.
- 14 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square  
15 tolerance of 1/8 inch (3 mm).

16 PART 3 - EXECUTION

17 3.1 EXAMINATION

- 18 A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements  
19 for installation tolerances and other conditions affecting performance of the Work.
- 20 B. Proceed with installation only after unsatisfactory conditions have been corrected.

21 3.2 PREPARATION

- 22 A. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall  
23 or slab at stud or joist locations.

24 3.3 INSTALLATION, GENERAL

- 25 A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- 26 B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written  
27 instructions unless more stringent requirements are indicated.
- 28 C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
- 29 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-  
30 to-line joints with maximum variation in plane and true position between fabricated panels not  
31 exceeding 1/16 inch (1.6 mm).
- 32 D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections  
33 securely fastened.
- 34 1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
  - E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
  - F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
  - G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
  - H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
  - I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- 3.4 NON-LOAD-BEARING WALL INSTALLATION
- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
  - B. Fasten both flanges of studs to top and bottom track unless otherwise indicated or at a deflection track that should not be fasted to top track. Space studs as follows:
    1. Stud Spacing: 16 inches (406 mm) maximum.
  - C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
  - D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
    1. Install single deep-leg deflection tracks and anchor to building structure.
    2. Install double deep-leg deflection tracks and anchor outer track to building structure.
    3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
    4. Connect drift clips to cold-formed steel framing and anchor to building structure.
  - E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
    1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
    2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
    3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

- 1 F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm)  
2 of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width  
3 and thickness matching studs, secured to stud webs or flanges.

- 4 1. Install solid blocking at 96-inch (2440-mm) centers.

- 5 G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles,  
6 continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

7 3.5 FIELD QUALITY CONTROL

- 8 A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests  
9 and inspections and prepare test reports.

- 10 B. Field and shop welds will be subject to testing and inspecting.

- 11 C. Testing agency will report test results promptly and in writing to Contractor and Architect.

- 12 D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

- 13 E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of  
14 replaced or additional work with specified requirements.

15 3.6 REPAIRS AND PROTECTION

- 16 A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-  
17 formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's  
18 written instructions.

- 19 B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer,  
20 that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial  
21 Completion.

22 END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Steel framing and supports for overhead doors.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Metal Ladder.
5. Pipe Bollards
6. Sump pit plate.
7. Bent plate pipe protection.
8. Steel shapes for supporting elevator door sills.
9. Cast-iron wheel guards.

- B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
2. Division 05 Section "Structural Steel Framing."
3. Division 06 Section "Rough Carpentry" for metal framing anchors.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

1. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## 1.4 SUBMITTALS

## A. Product Data: For the following:

1. Paint products.
2. Grout.

## B. Shop Drawings: Show fabrication and installation details for metal fabrications including anchorage details.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## C. Qualification Data: For professional engineer.

## 1.5 QUALITY ASSURANCE

## A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

## 1.6 PROJECT CONDITIONS

## A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

## 1.7 COORDINATION

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

## B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.



## 1 PART 2 - PRODUCTS

## 2 2.1 METALS, GENERAL

- 3 A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For  
4 metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller  
5 marks, rolled trade names, or blemishes.

## 6 2.2 FERROUS METALS

- 7 A. Steel Plates, Shapes, and Bars: ASTM A 36.

- 8 B. Rolled-Steel Floor Plate: ASTM A 786, rolled from plate complying with ASTM A 36 or ASTM A 283,  
9 Grade C or D.

- 10 C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

- 11 D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by  
12 structural loads.

- 13 E. Cast Iron: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

## 14 2.3 NONFERROUS METALS

- 15 A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.

- 16 B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or 6063-T6.

## 17 2.4 FASTENERS

- 18 A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563;  
19 and, where indicated, flat washers.

- 20 B. Anchor Bolts: ASTM F 1554, Grade 36.

- 21 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is  
22 indicated to be galvanized.

- 23 C. Eyebolts: ASTM A 489.

- 24 D. Machine Screws: ASME B18.6.3.

- 25 E. Lag Bolts: ASME B18.2.1.

- 26 F. Wood Screws: Flat head, ASME B18.6.1.

- 27 G. Plain Washers: Round, ASME B18.22.1.

- 28 H. Lock Washers: Helical, spring type, ASME B18.21.1.

I. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153.

J. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

## 2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

## 2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer unless indicated to be galvanized.

## 2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.

## 2.9 METAL FLOOR PLATE

- A. Fabricate from rolled-steel floor plate of thickness indicated below:

1. Thickness: 1/4 inch.

- B. Provide steel angle supports as indicated.

- C. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

- D. Locations:

1. Elevator Sump Pit Covers

## 2.10 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.

## 2.11 BENT PLATE PIPE PROTECTION

- A. Provide bent plate in thickness indicated on Drawings. Form to profile indicated on Drawings.

## 2.12 CAST-IRON WHEEL GUARDS

- A. Provide wheel guards of 3/4-inch- thick, hollow-core, gray-iron castings; of size and shape indicated. Provide holes for countersunk anchor bolts and grouting.

## 2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Finish metal fabrications after assembly.

## 2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

## 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

## 3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

## 3.4 INSTALLING BEARING AND LEVELING PLATES

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

## 3.5 INSTALLING CAST-IRON WHEEL GUARDS

- A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete

## 3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

## 1 SECTION 055113 - METAL PAN STAIRS

## 2 PART 1 - GENERAL

## 3 1.1 SUMMARY

## 4 A. Section Includes:

- 5 1. Preassembled steel stairs with concrete-filled treads.
- 6 2. Preassembled steel stairs with precast terrazzo treads.
- 7 3. Steel tube handrails attached to walls adjacent to metal stairs and return to walking surface.
- 8 4. Steel tube handrails returning to walking surface.

## 9 1.2 COORDINATION

- 10 A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and  
11 coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible  
12 with one another.
- 13 B. Coordinate installation of anchorages for metal stairs and railings. Furnish setting drawings, templates,  
14 and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with  
15 integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in  
16 time for installation.
- 17 C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required  
18 stair width and are within the fire-resistance-rated stair enclosure.

## 19 1.3 ACTION SUBMITTALS

- 20 A. Product Data: For metal pan stairs and paint products.
  - 21 1. Precast terrazzo treads.
- 22 B. Shop Drawings:
  - 23 1. Include plans, elevations, sections, details, and attachments to other work.
  - 24 2. Indicate profile and dimensions of precast terrazzo treads.
- 25 C. Samples for Verification: For each type and finish of precast terrazzo tread.
- 26 D. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the  
27 qualified professional engineer responsible for their preparation.

## 28 1.4 INFORMATIONAL SUBMITTALS

- 29 A. Welding certificates.
- 30 B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying  
31 that shop primers are compatible with topcoats.

## 1.5 QUALITY ASSURANCE

## A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

## A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings.

## B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to  $L/360$  or 1/4 inch (6.4 mm), whichever is less.

## C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

## 1. Handrails:

- a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
- b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

## 2. Infill of Guards:

- a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
- b. Infill load and other loads need not be assumed to act concurrently.
- c.

## D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

## 2.2 METALS

## A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

## B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.



- 1 C. Steel Tubing for Railings and Guards: ASTM A 500 (cold formed) or ASTM A 513.
- 2 D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless  
3 otherwise indicated
- 4 E. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial steel, Type B, or  
5 structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

6 2.3 FASTENERS

- 7 A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941  
8 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.  
9 Select fasteners for type, grade, and class required.
- 10 B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property  
11 Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- 12 C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563  
13 (ASTM A 563M); and, where indicated, flat washers.
- 14 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be  
15 galvanized.
- 16 D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining,  
17 without failure, a load equal to six times the load imposed when installed in unit masonry and four times  
18 the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M,  
19 conducted by a qualified independent testing agency.
- 20 1. Material: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts,  
21 ASTM F 594 (ASTM F 836M).

22 2.4 MISCELLANEOUS MATERIALS

- 23 A. Handrail Wall Brackets: Cast nickel-silver.
- 24 B. Shop Primers: Provide primers that comply with Section 099000 "Painting and Coating."
- 25 C. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place  
26 Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive  
27 strength of 3000 psi (20 MPa) unless otherwise indicated.

28 2.5 PRECAST TERRAZZO TREADS

- 29 A. Precast Terrazzo Stair Treads: Epoxy terrazzo units cast in maximum lengths possible. Comply with  
30 manufacturer's written instructions for fabricating precast terrazzo units in sizes and profiles indicated.
- 31 1. Epoxy Resin Matrix: Manufacturer's standard recommended for use indicated.
- 32 2. Aggregates: Comply with NTMA gradation standards for mix indicated, and containing no  
33 deleterious or foreign matter.
- 34 a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
- 35 b. 24-Hour Absorption Rate: Less than 0.75 percent.
- 36 c. Dust Content: Less than 1.0 percent by weight.

3. Reinforcement: ASTM A615/A615M, Grade 60 bars, as required by unit size, profile, and thickness.
4. Abrasive Inserts: 1/2-inch- wide, silicon carbon/epoxy mixture.
  - a. Provide two inserts, 1/2 inch (13 mm) apart, with first insert located 1 inch (25 mm) from nosing at adjacent stair riser locations. Stop inserts 3 inches from end of each tread.
5. Color: Match resinous-matrix terrazzo flooring.
6. Finish: Honed.
7. Surface Sealer: Slip- and stain-resistant, penetrating sealer that is chemically neutral with pH factor between 7 and 8; does not affect color or physical properties of terrazzo type indicated; is recommend by sealer manufacturer for use with specified terrazzo; and complies with NTMA guide specification for terrazzo type applicable for this Project.

## 2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  1. Join components by welding unless otherwise indicated.
  2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Weld exposed corners and seams continuously unless otherwise indicated.
  5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

## 2.7 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
1. Fabricate stringers of steel channels or steel tubes as indicated on Drawings.
    - a. Provide closures for exposed ends of channel stringers.
    - b. Finish: Shop primed and field painted.
  2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
  3. Weld stringers to headers; weld framing members to stringers and headers.
  4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
  5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subreads pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).
1. Steel Sheet: Galvanized-steel sheet.
  2. Directly weld metal pans to stringers; locate welds on top of subreads where they are concealed by concrete fill. Do not weld risers to stringers.
  3. Shape metal pans to include nosing integral with riser.
  4. Provide subplatforms of configuration indicated or, if not indicated, the same as subreads. Weld subplatforms to platform framing.
    - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

## 2.8 FABRICATION OF STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
1. Steel tube handrails: 1-1/2-inch- (38-mm-) diameter handrail.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.
- C. Form changes in direction of railings by bending unless otherwise indicated.

- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
1. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
  2. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

## 2.9 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to surfaces of metal stair components, except those embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.1 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install hanger rods, struts, and connections concealed within stairway walls where they will not be visible in the completed Work, unless otherwise indicated.
- D. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

G. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

H. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

### 3.2 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by bolting to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

### 3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055113

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### SECTION 055213 - PIPE AND TUBE RAILINGS

**TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.

**Content Requests:**

[<Double click here to submit questions, comments, or suggested edits to this Section.>](#)

**Access Manufacturer-Provided, AIA MasterSpec-Based Sections:**

[<Double click here for this Section based on specific manufacturer's products set as Basis-of-Design at ProductMasterSpec.com.>](#)

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

### 1.2 SUMMARY

A. Section Includes:

1. Aluminum railings.
2. Stainless steel railings.

B. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Delete first subparagraph below if railings for metal stairs are specified in this Section.

1. Section 055113 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.
2. Section 057300 "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes and guard-infill metals.

### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

### 1.4 ACTION SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs below for two-stage Samples.

- B. Samples for Verification: For each type of exposed finish required.
  1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
  2. Fittings and brackets.
  3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
    - a. Show method of connecting and finishing members at intersections.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor.

- C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.5 INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

- A. Qualification Data: For delegated-design professional engineer.

Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

- B. Welding certificates.

1 Retain "Mill Certificates" Paragraph below if increased corrosion resistance of Type 316 stainless steel is required.

2 Consider retaining "Paint Compatibility Certificates" Paragraph below if primers are fully specified in this Section  
3 rather than in painting Sections.

4 "Product Test Reports" Paragraph below may be used for verification of performance requirements if authorities  
5 having jurisdiction do not allow Contractor to provide engineering calculations.

- 6 C. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable  
7 to authorities having jurisdiction.

## 8 1.6 QUALITY ASSURANCE

9 Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining, also retain  
10 "Welding certificates" Paragraph in "Informational Submittals" Article.

- 11 A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

- 12 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- 13 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- 14 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

## 15 1.7 DELIVERY, STORAGE, AND HANDLING

- 16 A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable,  
17 temporary protective covering before shipping.

## 18 1.8 FIELD CONDITIONS

19 If possible, design railings, so that they do not have to fit other construction, and delete this article.

- 20 A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by  
21 field measurements before fabrication.

## 22 PART 2 - PRODUCTS

23 Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor  
24 endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply  
25 with requirements retained or revised in descriptions and are both available and suitable for the intended  
26 applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000  
27 "Product Requirements."

## 28 2.1 PERFORMANCE REQUIREMENTS

29 Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

- 30 A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality  
31 Requirements," to design railings, including attachment to building construction.



- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

Subparagraphs below are based on the International Building Code; revise to suit Project and to comply with requirements of authorities having jurisdiction.

1. Handrails and Top Rails of Guards:

- a. Uniform load of 50 lbf/ft. applied in any direction.
- b. Concentrated load of 200 lbf applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

Delete "Thermal Movements" Paragraph below if only interior railings are required.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

Differential values in "Temperature Change" Subparagraph below (for aluminum in particular) are suitable for most of the United States.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface or guardrail assembly.

2.3 ALUMINUM RAILINGS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

Retain applicable material types, qualities, and grades from paragraphs below.

- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

Alloys and tempers in first six paragraphs below are typical for products listed when used in railings; revise to suit structural performance requirements.

Aluminum railings are usually made from round tubing rather than pipe. For round tube railings, usually retain first three paragraphs below if Contractor is required to design railings. For pipe railings, retain only second paragraph unless first paragraph is required for bars. For square tube railings, retain only first paragraph. Primary difference between round tubing and pipe is in OD. Pipe sizes are normally indicated by use of NPS designator and weight class or schedule number; for tubing, OD and wall thickness are used. See the Evaluations.

Yield strength for Alloy 6063-T5/T52 is 15 to 16 ksi (105 to 110 MPa).

C. Extruded Tubing: ASTM B221, Alloy 6063-T5/T52.

Yield strength for Alloy 6063-T6 is 25 ksi (172 MPa).

D. Extruded Structural Round Tubing: ASTM B429/B429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

Yield strength for Alloy 6063-T832 is 35 to 36 ksi (240 to 250 MPa).

E. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.

Yield strength for Alloy 6061-T6 is 32 to 35 ksi (220 to 240 MPa). Note that 6061-T6 is unsuitable for bending, is somewhat less corrosion resistant than 6063, and does not anodize as well as 6063; however, 6063 is not available in plate and sheet form.

## 2.4 STAINLESS STEEL RAILINGS

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

Retain applicable material types, qualities, and grades from paragraphs below. Type 304 stainless steel is usually standard; Type 316 or 316L provides better corrosion resistance in coastal environments and where subject to deicing salts. If welding is required, use Type 316L instead of Type 316.

Stainless steel railings are usually made from tubing rather than pipe. Stainless steel tubing is not annealed, pickled, or pressure tested, so it is less expensive than stainless steel pipe. Primary difference between round stainless steel tubing and stainless steel pipe is in OD. Pipe sizes are typically indicated by use of NPS designator and weight class or schedule number; for tubing, OD and wall thickness are used. See Evaluations.

B. Tubing: ASTM A554, Grade MT 304.

C. Pipe: ASTM A312/A312M, Grade TP 304.

Retain first option in "Castings" Paragraph below with Type 304; second option, with Type 316 or 316L.

D. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

E. Plate and Sheet: ASTM A240/A240M or ASTM A666, Type 304.

## 2.5 FASTENERS

A. Fastener Materials:

Many fasteners, such as small-diameter machine screws, are not available hot-dip galvanized.

1. Aluminum Railing Components: Type 304 stainless steel fasteners.

2. Stainless Steel Railing Components: Type 304 stainless steel fasteners.

Retain subparagraph below if exposed fasteners are allowed, especially with color anodic finish.

3. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

Retain one of first two subparagraphs below.

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

Delete subparagraph below or revise if another type of head is required or is standard with system selected.

3. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

In "Post-Installed Anchors" Paragraph below, ICC-ES AC193 is for mechanical anchors, and ICC-ES AC308 is for adhesive anchors.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

Material in "Material for Interior Locations" Subparagraph below protects against corrosion in an indoor atmosphere.

Alloy Group 1 (A1) refers to Type 304 and similar alloys, and Alloy Group 2 (A4) refers to Type 316 and similar alloys.

1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.6 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast stainless steel.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

1. For aluminum and stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

Retain "Nonshrink, Nonmetallic Grout" or "Anchoring Cement" Paragraph below, or both, to suit Project.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated on Drawings, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.

2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.

2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.

2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.

"Welded Connections" Paragraph below is generally applicable to exposed welding of steel and stainless steel.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.

4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

"Welded Connections for Aluminum Pipe" Paragraph below is an example only and is based on CraneVeyor's system.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

Subparagraph below is an alternative to concealed mechanical fasteners and fittings.

1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.

K. Form changes in direction as follows:

1 Retain one of four subparagraphs below. Second subparagraph allows fabricator to choose radius of bends. Third is  
2 for flush (zero-radius) bends. Fourth is for radii that are indicated on Drawings.

- 3 1. By bending to smallest radius that will not result in distortion of railing member.

4 Retain first paragraph below if bending is allowed or required.

- 5 L. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross  
6 section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming  
7 exposed surfaces of components.

- 8 M. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and  
9 finish as railings.

- 10 N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns  
11 unless clearance between end of rail and wall is 1/4 inch or less.

- 12 O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and  
13 anchors to interconnect railing members to other work unless otherwise indicated.

14 Retain subparagraph below if any railings are supported from plaster or gypsum board walls.

- 15 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant  
16 fillers or other means to transfer loads through wall finishes to structural supports and prevent  
17 bracket or fitting rotation and crushing of substrate.

- 18 P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

- 19 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.  
20 2. Coordinate anchorage devices with supporting structure.

21 Delete first paragraph below if no posts are set in concrete or if posts are set without sleeves.

- 22 Q. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside  
23 dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming  
24 bottom closure.

## 25 2.8 ALUMINUM FINISHES

26 Delete "Appearance of Finished Work" Paragraph below if no variable finishes, such as color-anodized aluminum,  
27 are used.

- 28 A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if  
29 they are within one-half of the range of approved Samples. Noticeable variations in the same piece are  
30 unacceptable. Variations in appearance of other components are acceptable if they are within the range of  
31 approved Samples and are assembled or installed to minimize contrast.

32 Retain or revise finishes below to suit Project. If retaining more than one, indicate location of each on Drawings or  
33 by inserts. Revise mill finish if custom mechanical finish is required and availability is verified.

- 34 B. Mill Finish: AA-M12, nonspecular as fabricated.

35 Retain one of two options in "Clear Anodic Finish" Paragraph below. Second option is standard with many  
36 manufacturers; first option is heavy anodized. Verify availability with manufacturers.

C. Clear Anodic Finish: AAMA 611, AA-M12C22A31.

Retain one of two options in "Color Anodic Finish" Paragraph below. Verify availability with manufacturers.

"Baked-Enamel or Powder-Coat Finish" Paragraph below references AAMA standard for pigmented organic coating on extrusions and panels.

Retain "High-Performance Organic Finish, Two-Coat Polyvinylidene Fluoride (PVDF)"; "Superior Performance Organic Finish, Three-Coat Polyvinylidene Fluoride (PVDF)"; "Superior Performance Organic Finish, Four-Coat Polyvinylidene Fluoride (PVDF)"; "Single-Coat Superior Performance FEVE Organic Finish"; or "Two-Coat Superior Performance FEVE Organic Finish" Paragraph below. If more than one finish is required, indicate location of each system on Drawings, in schedules, or by inserts. If specific products are required, name coating manufacturers and products.

In "High-Performance Organic Finish, Two-Coat Polyvinylidene Fluoride (PVDF)" Paragraph below, retain AAMA 2604 with 50 percent resin content by weight in color coat or AAMA 2605 with 70 percent resin content by weight in color coat for high-performance organic coatings on extrusions and panels.

## 2.9 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

Retain first subparagraph below for directional finishes.

1. Run grain with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces.
3. Remove embedded foreign matter and leave surfaces chemically clean.

C. Stainless Steel Pipe and Tubing Finishes:

Retain "180-Grit Polished Finish," "320-Grit Polished Finish," or "Polished and Buffed Finish" subparagraphs below. Coordinate with other Sections that include stainless steel railings to ensure uniform finish throughout Project, if desired, as finishes between manufacturers seldom match. Insert other finishes as required after verifying availability with manufacturers. See the Evaluations.

180-grit polished finish is the most common finish for grab bars, handrails, and restaurant equipment tubing.

1. 180-Grit Polished Finish: Uniform, directionally textured finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

Delete this article if no handrails are attached to plaster or gypsum board assemblies.

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

## 3.2 INSTALLATION, GENERAL

## A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

Revise two subparagraphs below if closer tolerances are required. Both are from NAAMM's "Pipe Railing Systems Manual."

5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

## B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

## C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

## D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

## 3.3 RAILING CONNECTIONS

Delete "Nonwelded Connections" or "Welded Connections" Paragraph below unless both methods are required. If both mechanical and welded connections are required, indicate locations of each on Drawings.

## A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

## B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

Retain "Expansion Joints" Paragraph below if expansion joints are required, or revise to suit Project. Indicate locations on Drawings based on temperature changes expected and coefficient of expansion of metals involved.

## 3.4 ANCHORING POSTS

Retain type(s) of anchorage in this article to suit Project.

Retain one of first two paragraphs below, or delete both if not using posts in concrete. Coordinate with products retained in Part 2.

- 1 A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing  
2 posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and  
3 concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with  
4 anchoring material manufacturer's written instructions.

5 Retain one of first two paragraphs below if retaining either concrete anchorage method above.

- 6 B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

7 Revise first paragraph below if posts are welded directly to supports.

- 8 C. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions,  
9 connected to posts and to metal supporting members as follows:

10 Retain one of three subparagraphs below. Welded and bolted connections of aluminum should be specially detailed.

- 11 1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.  
12 2. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this  
13 purpose.  
14 3. For stainless steel railings, weld flanges to post and bolt to supporting surfaces.

15 Retain paragraph below if applicable.

- 16 D. Install removable railing sections, where indicated, in slip-fit stainless steel sockets cast in concrete.

### 17 3.5 ATTACHING RAILINGS

18 Delete first two paragraphs below if railing ends are not returned to walls.

- 19 A. Attach handrails to guardrail assemblies as shown on Drawings.

### 20 3.6 CLEANING

- 21 A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with  
22 clean water.

- 23 B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to  
24 comply with ASTM A780/A780M.

### 25 3.7 PROTECTION

- 26 A. Protect finishes of railings from damage during construction period with temporary protective coverings  
27 approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

- 28 B. Restore finishes damaged during installation and construction period, so no evidence remains of  
29 correction work. Return items that cannot be refinished in the field to the shop; make required alterations  
30 and refinish entire unit, or provide new units.

31 END OF SECTION 055213



## 1 SECTION 061000 - ROUGH CARPENTRY

## 2 PART 1 - GENERAL

## 3 1.1 RELATED DOCUMENTS

- 4 A. Drawings and general provisions of the Contract apply to this Section.

## 5 1.2 SUMMARY

- 6 A. Section Includes:

- 7 1. Framing with dimension lumber.
- 8 2. Wood blocking, cants, and nailers.
- 9 3. Wood furring and grounds.
- 10 4. Plywood backing panels.
- 11 5. Utility Shelving.
- 12 6. Lock-Deck Laminated Decking

- 13 B. Related Requirements:

- 14 1. Division 06 Section "Sheathing."

## 15 1.3 DEFINITIONS

- 16 A. Exposed Framing: Framing not concealed by other construction.

- 17 B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches
- 
- 18 nominal (114 mm actual) in least dimension.

- 19 C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

- 20 1. NeLMA: Northeastern Lumber Manufacturers' Association.
- 21 2. NLGA: National Lumber Grades Authority.
- 22 3. RIS: Redwood Inspection Service.
- 23 4. SPIB: The Southern Pine Inspection Bureau.

## 24 1.4 ACTION SUBMITTALS

- 25 A. Product Data: For each type of process and factory-fabricated product. Indicate component materials
- 
- 26 and dimensions and include construction and application details.

- 27 1. Include data for wood-preservative treatment from chemical treatment manufacturer and  
28 certification by treating plant that treated materials comply with requirements. Indicate type of  
29 preservative used and net amount of preservative retained.
- 30 2. For products receiving a waterborne treatment, include statement that moisture content of treated  
31 materials was reduced to levels specified before shipment to Project site.
- 32 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
  2. Power-driven fasteners.
  3. Powder-actuated fasteners.
  4. Metal framing anchors.
  5. Fire-retardant treated wood.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Volatile Organic Compounds (VOCs): Comply with Pennsylvania's state and local VOC regulations for adhesives, sealants, paints, and coatings applied on site. Submit documentation showing compliance for each VOC-emitting material and product utilized in this Section.

## PART 2 - PRODUCTS

## 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
  3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

## 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
  2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
  5. Wood floor plates that are installed over concrete slabs-on-grade.
  6. Do not treat wood designated to be fire-retardant treated.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Treatment shall not promote corrosion of metal fasteners.
  2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on drawings and the following:

1. Wood construction located in fire-rated wall construction.

#### 2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.
7. Utility shelving.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:

1. Mixed southern pine; SPIB.
2. Spruce-pine-fir; NLGA.
3. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. For utility shelving, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For blocking and nailers used for attachment of other construction, select, and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

#### 2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, C-C Plugged in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

## 2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).
- H. Screws for Fastening to Metal Framing: ASTM C 1002 length as recommended by screw manufacturer for material being fastened.

## 2.7 METAL FRAMING ANCHORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
1. Use for wood-preservative-treated lumber and where indicated.
- D. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.

- 1 E. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm)  
2 above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and  
3 standoff and adjustment plates 0.108 inch (2.8 mm) thick.
- 4 F. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches (38  
5 mm) wide by 0.050 inch (1.3 mm) thick. Tie fastens to side of rafter or truss, face of top plates, and side  
6 of stud below.
- 7 G. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to  
8 other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters  
9 from reinforced base.

10 2.8 MISCELLANEOUS MATERIALS

- 11 A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's  
12 standard widths to suit width of sill members indicated.
- 13 B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or  
14 rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded  
15 polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
- 16 C. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D 3498 that is  
17 approved for use indicated by adhesive manufacturer.
- 18 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59,  
19 Subpart D (EPA Method 24).
- 20 2. Adhesives shall comply with the testing and product requirements of the California Department of  
21 Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various  
22 Sources Using Small-Scale Environmental Chambers."
- 23 D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl  
24 butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

25 2.9 LOCK-DECK LAMINATED DECKING

- 26 A. Manufacturers: Acceptable Manufacturer: Disdero Lumber Co., which is located at: 12301 S. E.  
27 Carpenter Dr.; Clackamas, OR 97015; Toll Free Tel: 800-547-4209; Tel: 503-239-8888; Fax: 503-607-  
28 2492; Email: requestinfo (gbrinck@disdero.com); Web: <http://www.lockdeck.com> | <http://www.disdero.com>
- 29 B. Materials for Laminated: Decking: Lock-Deck Laminated Decking.
- 30 1. Species: Douglas Fir/Larch.
- 31 2. Pattern: Standard Vee.
- 32 3. Tongue-And Groove Edges: Center laminations shall be offset and machined to form a tongue and  
33 groove on both the edges.
- 34 4. Ends: End matched (tongue-and-groove).
- 35 5. Random Length Continuous Spans: 6' to 16', shipped in multiples of 1 foot and 1 inch short of  
36 nominal.
- 37 6. Nominal Size: 3x6.
- 38 7. Nominal Size: 3x8.
- 39 8. Nominal Size: 5x6.
- 40 9. Nominal Size: 5x8.
- 41 10. Surface Texture: Smooth Sanded.
- 42 11. Moisture Content: 10% to 12% average, maximum 15%.

12. Laminating Adhesive: Exterior 100 percent waterproof type, meeting ASTM D 2559. Laminated decking shall be cured under pressure using high frequency electronics in a radio frequency (RF) press.
13. Quality Control: Manufactured in accordance with ANSI/AITC 190.1 and certified by an independent inspection agency.
14. Factory Finish - Stain: One coat of factory-applied, oven-dried acrylic, semi-transparent stain with mildewcide/fungicide.
  - a. Color as selected.
15. Factory Finish - Clear Sealer: Matte finish.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.
  3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.

- 1 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20  
2 feet (6 m) o.c.
- 3 J. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening  
4 other materials to lumber. Do not use materials with defects that interfere with function of member or  
5 pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- 6 K. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- 7 1. Use inorganic boron for items that are continuously protected from liquid water.  
8 2. Use copper naphthenate for items not continuously protected from liquid water.
- 9 L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying  
10 with the following:
- 11 1. NES NER-272 for power-driven fasteners.  
12 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.  
13 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate  
14 Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- 15 M. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate  
16 members where opposite side will be exposed to view or will receive finish materials. Make tight  
17 connections between members. Install fasteners without splitting wood. Drive nails snug but do not  
18 countersink nail heads unless otherwise indicated.
- 19
- 20 N. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners  
21 evenly spaced, and with adjacent rows staggered.
- 22 1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.
- 23 3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION
- 24 A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as  
25 required for true line and level of attached work. Coordinate locations with other work involved.
- 26 B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless  
27 otherwise indicated.
- 28 C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible  
29 flashing separator between wood and metal decking.
- 30 D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-  
31 1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish  
32 material. Remove temporary grounds when no longer required.
- 33 3.3 WOOD FURRING INSTALLATION
- 34 A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for  
35 tolerance of finish work.
- 36 B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-)  
37 size furring vertically at 24 inches (610 mm) o.c.



- 1 C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring  
2 vertically at 16 inches (406 mm) o.c.

3 3.4 PROTECTION

- 4 A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection,  
5 inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate  
6 solution by spraying to comply with EPA-registered label.

- 7 B. Protect rough carpentry from weather.

8 3.5 EXECUTION OF LOCK-DECK LAMINATED DECKING

9 A. EXAMINATION

- 10 B. Do not begin installation until substrates have been properly prepared.

- 11 C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory  
12 preparation before proceeding.

13 D. PREPARATION

- 14 E. Clean surfaces thoroughly prior to installation.

- 15 F. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for  
16 the substrate under the project conditions.

17 G. INSTALLATION

- 18 H. Install in accordance with manufacturer's instructions.

- 19 I. Install deck with tongue up on all sloped surfaces.

20 J. PROTECTION

- 21 K. Store material on jobsite on blocking which raises material at least 6 inches above the ground. Cover  
22 material with vapor barrier with at least 2 inch air space for ventilation.

- 23 L. Protect installed products until completion of project. Cover decking with a single layer of roofing felt,  
24 lapped 4 inches minimum, immediately after installation.

- 25 M. Use 15 pound felt for slopes 2:12 to 6:12.

- 26 N. Use 30 pound felt for slopes over 6:12.

- 27 O. Touch-up, repair or replace damaged products before Substantial Completion.

28 END OF SECTION 061000  
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1 SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Wood blocking and nailers.  
6 2. Plywood backing panels.

7 B. Related Requirements:

- 8 1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

9 1.2 DEFINITIONS

- 10 A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches  
11 nominal (114 mm actual) size in least dimension.

12 1.3 ACTION SUBMITTALS

- 13 A. Product Data: For each type of process and factory-fabricated product. Indicate component materials  
14 and dimensions and include construction and application details.

- 15 1. Include data for wood-preserved treatment from chemical treatment manufacturer and  
16 certification by treating plant that treated materials comply with requirements. Indicate type of  
17 preservative used and net amount of preservative retained.  
18 2. For products receiving a waterborne treatment, include statement that moisture content of treated  
19 materials was reduced to levels specified before shipment to Project site.

20 1.4 INFORMATIONAL SUBMITTALS

- 21 A. Evaluation Reports: For the following, from ICC-ES:

- 22 1. Preservative-treated wood.  
23 2. Fire-retardant-treated wood.  
24 3. Power-driven fasteners.  
25 4. Post-installed anchors.

26 1.5 DELIVERY, STORAGE, AND HANDLING

- 27 A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect  
28 lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air  
29 circulation around stacks and under coverings.

## 1 PART 2 - PRODUCTS

## 2 2.1 WOOD PRODUCTS, GENERAL

3 A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is  
4 indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by  
5 the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of  
6 Review to inspect and grade lumber under the rules indicated.

- 7 1. Factory mark each piece of lumber with grade stamp of grading agency.  
8 2. Dress lumber, S4S, unless otherwise indicated.

9 B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

## 10 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

11 A. Preservative Treatment by Pressure Process: AWP U1; Use Category UC2.

- 12 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or  
13 chromium.

14 B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is  
15 warped or does not comply with requirements for untreated material.

16 C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of  
17 Review.

18 D. Application: Treat items indicated on Drawings, and the following:

- 19 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in  
20 connection with roofing, flashing, vapor barriers, and waterproofing.  
21 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or  
22 concrete.

## 23 2.3 FIRE-RETARDANT-TREATED MATERIALS

24 A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in  
25 this article, that are acceptable to authorities having jurisdiction, and with fire-test-response  
26 characteristics specified as determined by testing identical products per test method indicated by a  
27 qualified testing agency.

28 B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of  
29 25 or less when tested according to ASTM E84, and with no evidence of significant progressive  
30 combustion when the test is extended an additional 20 minutes, and with the flame front not extending  
31 more than 10.5 feet beyond the centerline of the burners at any time during the test.

- 32 1. Treatment shall not promote corrosion of metal fasteners.  
33 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-  
34 retardant-treated lumber and plywood by pressure process after being subjected to accelerated  
35 weathering according to ASTM D2898. Use for exterior locations and where indicated.  
36 3. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood  
37 after treatment to a maximum moisture content of 15 percent.

- 1 4. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing  
2 agency.

3 2.4 MISCELLANEOUS LUMBER

- 4 A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other  
5 construction, including blocking and nailers.

- 6 1. Blocking.  
7 2. Nailers.  
8 3. Rooftop equipment bases and support curbs.  
9 4. Cants.  
10 5. Furring.  
11 6. Grounds.  
12 7. Utility shelving.

- 13 B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

- 14 1. Hem-fir (north); NLGA.  
15 2. Mixed southern pine or southern pine; SPIB.  
16 3. Spruce-pine-fir; NLGA.  
17 4. Hem-fir; WCLIB or WWPA.  
18 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.  
19 6. Western woods; WCLIB or WWPA.  
20 7. Northern species; NLGA.  
21 8. Eastern softwoods; NeLMA.

- 22 C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any  
23 species may be used provided that it is cut and selected to eliminate defects that will interfere with its  
24 attachment and purpose.

- 25 D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate  
26 knots and other defects that will interfere with attachment of other work.

27 2.5 PLYWOOD BACKING PANELS

- 28 A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in  
29 thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

30 2.6 FASTENERS

- 31 A. General: Provide fasteners of size and type indicated that comply with requirements specified in this  
32 article for material and manufacture.

- 33 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area  
34 of high relative humidity, provide fasteners with hot-dip zinc coating complying with  
35 ASTM A 153/A 153M; of Type 304 stainless steel; or proprietary coated fasteners recommended  
36 by manufacturer for use with treated wood.

- 37 B. Nails, Brads, and Staples: ASTM F 1667.

- 38 C. Screws for Fastening to Metal Framing: Length as recommended by screw manufacturer for material  
39 being fastened, and complying with the following:

1. ASTM C 1002 for fastening to non-load-bearing steel framing.
2. ASTM C 954 for fastening to cold-formed steel framing.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

## 2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Do not splice structural members between supports unless otherwise indicated.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight

1 connections between members. Install fasteners without splitting wood. Drive nails snug but do not  
2 countersink nail heads unless otherwise indicated.

3 3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

4 A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as  
5 required for true line and level of attached work. Coordinate locations with other work involved.

6 B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless  
7 otherwise indicated.

8 END OF SECTION 061053

1 SECTION 061600 - SHEATHING

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Gypsum sheathing.

6 B. Related Requirements:

- 7 1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.

8 1.2 ACTION SUBMITTALS

9 A. Product Data: For each type of process and factory-fabricated product. Indicate component materials  
10 and dimensions and include construction and application details.

- 11 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by  
12 treating plant that treated plywood complies with requirements. Include physical properties of  
13 treated materials.  
14 2. For fire-retardant treatments, include physical properties of treated plywood both before and after  
15 exposure to elevated temperatures, based on testing by a qualified independent testing agency  
16 according to ASTM D 5516.  
17 3. For products receiving waterborne treatment, include statement that moisture content of treated  
18 materials was reduced to levels specified before shipment to Project site.

19 1.3 QUALITY ASSURANCE

20 A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-  
21 treated material, an inspection agency acceptable to authorities having jurisdiction that periodically  
22 performs inspections to verify that the material bearing the classification marking is representative of the  
23 material tested.

24 1.4 DELIVERY, STORAGE, AND HANDLING

25 A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect  
26 sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air  
27 circulation around stacks and under coverings.

28 PART 2 - PRODUCTS

29 2.1 GYPSUM SHEATHING

30 A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

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



- 1 a. CertainTeed Corporation; GlasRoc.
- 2 b. Georgia-Pacific Building Products; Dens-Glass Gold.
- 3 c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
- 4 d. Temple-Inland Building Products by Georgia-Pacific; GreenGlass Exterior Sheathing.
- 5 e. United States Gypsum Company; Securock.

- 6 2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
- 7 3. Size: 48 inches (1219 mm) by maximum length available.

## 8 2.2 FASTENERS

- 9 A. General: Provide fasteners of size and type indicated that comply with requirements specified in this
- 10 article for material and manufacture.
- 11 1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with
- 12 ASTM A 153/A 153M.
- 13 B. Nails, Brads, and Staples: ASTM F 1667.
- 14 C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having
- 15 jurisdiction, based on ICC-ES AC70.
- 16 D. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with
- 17 wafer heads and reamer wings, length as recommended by screw manufacturer for material being
- 18 fastened.
- 19 E. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length
- 20 recommended by sheathing manufacturer for thickness of sheathing to be attached.
- 21 1. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with
- 22 ASTM C 954.

## 23 PART 3 - EXECUTION

### 24 3.1 INSTALLATION, GENERAL

- 25 A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with
- 26 minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span
- 27 between fewer than three support members.
- 28 B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction
- 29 unless otherwise indicated.
- 30 C. Securely attach to substrate by fastening as indicated, complying with the following:
- 31 1. "Fastening Schedule," in the ICC's International Building Code.
- 32 2. ICC-ES evaluation report for fastener.
- 33 D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural
- 34 support elements.
- 35 E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not
- 36 exposed to precipitation or left exposed at end of the workday when rain is forecast.

## 3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

## 1. Combination Subfloor-Underlayment:

- a. Screw to cold-formed metal framing.
- b. Space panels 1/8 inch (3 mm) apart at edges and ends.

## 2. Wall and Roof Sheathing:

- a. Screw to cold-formed metal framing.
- b. Space panels 1/8 inch (3 mm) apart at edges and ends.

## 3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

- 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
- 2. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
- 3. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

- 1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.

END OF SECTION 061600

1 SECTION 062013 - EXTERIOR FINISH CARPENTRY

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Lumber soffits.

- 9 B. Related Requirements:

- 10 1. Section 061053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work  
11 not exposed to view.

12 1.3 ACTION SUBMITTALS

- 13 A. Product Data: For each type of process and factory-fabricated product. Indicate component materials,  
14 dimensions, profiles, textures, and colors and include construction and application details.

- 15 1. Include data for wood-preservative treatment from chemical-treatment manufacturer and  
16 certification by treating plant that treated materials comply with requirements. Indicate type of  
17 preservative used and net amount of preservative retained. Include chemical-treatment  
18 manufacturer's written instructions for finishing treated material.  
19 2. For products receiving a waterborne treatment, include statement that moisture content of treated  
20 materials was reduced before shipment to Project site to levels specified.

- 21 B. Samples: For each exposed product and for each color and texture specified.

22 1.4 DELIVERY, STORAGE, AND HANDLING

- 23 A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

- 24 1. Protect materials from weather by covering with waterproof sheeting, securely anchored.  
25 2. Provide for air circulation around stacks and under coverings.

26 1.5 FIELD CONDITIONS

- 27 A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit  
28 work to be performed and at least one coat of specified finish can be applied without exposure to rain,  
29 snow, or dampness.

- 30 B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece

### 2.2 LUMBER SOFFITS

- A. Provide kiln-dried lumber siding complying with DOC PS 20.
- B. Species and Grade: Western red cedar; NLGA, WCLIB, or WWPA Grade A.
- C. Pattern: V-edge, smooth-faced tongue and groove, actual face width (coverage) and thickness of 5-1/8 by 23/32 inch.

### 2.3 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
  1. For face-fastening siding, provide ringed-shank siding nails.
  2. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
  3. For applications not otherwise indicated, provide stainless steel fasteners.
- B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.
- C. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

### 2.4 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.

## 1 PART 3 - EXECUTION

## 2 3.1 EXAMINATION

- 3 A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances  
4 and other conditions affecting performance of the Work.
- 5 B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged,  
6 and mold damaged.
- 7 C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 8 3.2 PREPARATION

- 9 A. Clean substrates of projections and substances detrimental to application.
- 10 B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.
- 11 1. Cut to required lengths and prime ends.

## 12 3.3 INSTALLATION, GENERAL

- 13 A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or  
14 too small to fabricate with proper jointing arrangements.
- 15 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- 16 B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.
- 17 1. Use concealed shims where necessary for alignment.
- 18 2. Scribe and cut exterior finish carpentry to fit adjoining work.
- 19 3. Refinish and seal cuts as recommended by manufacturer.
- 20 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish  
21 carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for  
22 reveal installation.
- 23 5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
- 24 6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

## 25 3.4 ADJUSTING

- 26 A. Replace exterior finish carpentry that is damaged or does not comply with requirements.
- 27 1. Exterior finish carpentry may be repaired or refinished if work complies with requirements and  
28 shows no evidence of repair or refinishing.
- 29 B. Adjust joinery for uniform appearance.

## 30 3.5 CLEANING

- 31 A. Clean exterior finish carpentry on exposed and semiexposed surfaces.

- 1        B.     Touch up factory-applied finishes to restore damaged or soiled areas.
- 2        3.6     PROTECTION
- 3        A.     Protect installed products from damage from weather and other causes during construction.
- 4        B.     Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
- 5            1.     Indications that materials are wet or moisture damaged include, but are not limited to,
- 6                    discoloration, sagging, or irregular shape.
- 7            2.     Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy
- 8                    surface contamination and discoloration.
- 9        END OF SECTION 062013

1 SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Wood cabinets for transparent finish.  
9 2. Wood furring, blocking, shims, and hanging strips for installing architectural cabinets that are not  
10 concealed within other construction.  
11 3. Shop finishing.

- 12 B. Related Requirements:

- 13 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging  
14 strips required for installing cabinets that are concealed within other construction before cabinet  
15 installation.

16 1.3 COORDINATION

- 17 A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of  
18 Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

19 1.4 ACTION SUBMITTALS

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

- 21 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification  
22 by treating plant that treated materials comply with requirements.

- 23 B. Shop Drawings: For architectural cabinets.

- 24 1. Include plans, elevations, sections, and attachment details.  
25 2. Show large-scale details.  
26 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking  
27 and reinforcement specified in other Sections.  
28 4. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.  
29 5. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers  
30 indicating the flitch and sequence within the flitch for each leaf.  
31 6. Apply AWI Quality Certification Program label to Shop Drawings.

- 32 C. Samples: For each exposed product and for each color and finish specified, in manufacturer's standard  
33 size.

D. Samples for Initial Selection: For each type of exposed finish.

E. Samples for Verification: For the following:

1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished cabinets.

#### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

C. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.9 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.



- 1 C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions  
2 for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to  
3 ensure that actual dimensions correspond to established dimensions.

4 PART 2 - PRODUCTS

5 2.1 ARCHITECTURAL CABINET MANUFACTURERS

- 6 A. Source Limitations: Engage a qualified woodworking firm to assume responsibility for production of  
7 architectural cabinets with sequence-matched wood veneers.

8 2.2 CABINETS, GENERAL

- 9 A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for  
10 grades of architectural cabinets indicated for construction, finishes, installation, and other requirements.

11 2.3 WOOD CABINETS FOR TRANSPARENT FINISH

- 12 A. Architectural Woodwork Standards Grade: Premium.

- 13 B. Type of Construction: Frameless.

- 14 C. Wood for Exposed Surfaces:

- 15 1. Species: Walnut.  
16 2. Blueprint Matching: Comply with veneer and other matching requirements indicated for blueprint-  
17 matched paneling.  
18 3. Cut: Plain sliced/plain sawn.  
19 4. Grain Direction: Vertically for fixed panels.  
20 5. Matching of Veneer Leaves: Slip match.  
21 6. Veneer Matching within Panel Face: Balance match.  
22 7. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single  
23 flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous  
24 match where veneers are interrupted perpendicular to the grain.

25 2.4 WOOD MATERIALS

- 26 A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each  
27 type of architectural cabinet and quality grade specified unless otherwise indicated.

28 2.5 FIRE-RETARDANT-TREATED MATERIALS

- 29 A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use  
30 materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics  
31 specified as determined by testing identical products per test method indicated by a qualified testing  
32 agency.

- 33 1. Use treated materials that comply with requirements of referenced quality standard. Do not use  
34 materials that are warped, discolored, or otherwise defective.

2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E84.

1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.

- D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.

- E. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: White.

- F. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

## 2.6 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

## 2.7 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

- 1 B. Fabricate architectural cabinets to dimensions, profiles, and details indicated. Ease edges and corners to  
2 1/16-inch radius unless otherwise indicated.
- 3 C. Complete fabrication, including assembly and hardware application, to maximum extent possible before  
4 shipment to Project site. Disassemble components only as necessary for shipment and installation. Where  
5 necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- 6 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will  
7 be complete.
- 8 2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install  
9 dowels, screws, bolted connectors, and other fastening devices that can be removed after trial  
10 fitting. Verify that various parts fit as intended and check measurements of assemblies against  
11 field measurements before disassembling for shipment.
- 12 D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and  
13 similar items. Locate openings accurately and use templates or roughing-in diagrams to produce  
14 accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## 15 2.8 SHOP FINISHING

- 16 A. General: Finish architectural cabinets at manufacturer's shop as specified in this Section. Defer only final  
17 touchup, cleaning, and polishing until after installation.
- 18 B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk  
19 fasteners, sealing concealed surfaces, and similar preparations for finishing architectural cabinets, as  
20 applicable to each unit of work.
- 21 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed  
22 surfaces of cabinets.
- 23 C. Transparent Finish:
- 24 1. Architectural Woodwork Standards Grade: Premium.
- 25 2. Finish: System - 5, conversion varnish.
- 26 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain  
27 wood before staining and finishing.
- 28 4. Staining: Match Architect's sample.
- 29 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
- 30 6. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D523.

## 31 PART 3 - EXECUTION

### 32 3.1 PREPARATION

- 33 A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72  
34 hours.

### 35 3.2 INSTALLATION

- 36 A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item  
37 to be installed.

- 1 B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- 2 C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with  
3 countersunk, concealed fasteners and blind nailing. Use fine finishing nails[ **or finishing screws**] for  
4 exposed fastening, countersunk and filled flush with cabinet surface.
- 5 1. For shop-finished items, use filler matching finish of items being installed.
- 6 D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed  
7 shims.
- 8 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at  
9 cuts.
- 10 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned.  
11 Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.  
12 Complete installation of hardware and accessory items as indicated.
- 13 3. Maintain veneer sequence matching of cabinets with transparent finish.
- 14 E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching  
15 filler.
- 16 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where  
17 only sealer/prime coats are shop applied.

18 3.3 FIELD QUALITY CONTROL

- 19 A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying  
20 that woodwork, including installation, complies with requirements of the Architectural Woodwork  
21 Standards for the specified grade.
- 22 1. Inspection entity shall prepare and submit report of inspection.

23 3.4 ADJUSTING AND CLEANING

- 24 A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where  
25 not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- 26 B. Clean, lubricate, and adjust hardware.
- 27 C. Clean cabinets on exposed and semiexposed surfaces. Touch up finishes to restore damaged or soiled  
28 areas.

29 END OF SECTION 064113

## SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Solid-surface-material countertops for plastic-laminate-faced architectural casework.
3. Solid-surface-material lavatory counter assemblies.
4. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

## B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

## 1.2 PREINSTALLATION MEETINGS

## A. Preinstallation Conference: Conduct conference at Project site.

## 1.3 ACTION SUBMITTALS

## A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, and cabinet hardware and accessories.

## B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
3. Show locations and sizes of Owner-purchased appliances.

## C. Samples for Initial Selection:

1. Plastic laminates.
2. Thermoset decorative panels.
3. Countertop material.

## D. Samples for Verification:

1. Plastic laminates, 12 by 12 inches (300 by 300 mm), for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Thermoset decorative panels, 12 by 12 inches (300 by 300 mm), for each color, pattern, and surface finish, with edge banding on one edge.
3. Exposed cabinet hardware and accessories, one unit for each type and finish.

4. Countertop material, 6 inches (150 mm) square.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product.

#### 1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

#### 1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

### PART 2 - PRODUCTS

#### 2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL FABRICATIONS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate fabrications indicated for construction, finishes, installation, and other requirements.

## 2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Premium.

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.

2. Vertical Surfaces: Grade VGS.

3. Edges: Grade VGS.

F. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

a. Edges of Thermoset Decorative Panel Shelves: High-pressure decorative laminate edge banding.

b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS or Grade CLS.

2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.

3. Drawer Bottoms: Thermoset decorative panels.

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

## 2.3 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Grade: Premium.

B. Solid-Surface-Material Type: Provide Standard Type.

C. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top.

2. Backsplash: Straight, slightly eased at corner.

3. Endsplash: Matching backsplash.

- D. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material unless otherwise indicated.
- E. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.
- F. Fabrication: Fabricate tops in one piece with shop-applied edges unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate with loose backsplashes for field assembly.

#### 2.4 CASEWORK AND COUNTER MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
  - 2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
  - 3. Softwood Plywood: DOC PS 1.
    - a. Plywood for Countertop Substrates: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
  - 4. Thermoset Decorative Panels (Melamine): Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
    - a. Colors: As selected by Architect from manufacturer's full range.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Abet Laminati, Inc.
    - b. Formica Corporation.
    - c. Lamin-Art, Inc.
    - d. Panolam Industries International, Inc.
    - e. Wilsonart International; Div. of Premark International, Inc.
  - 2. Colors, Patterns, and Finishes: As indicated by manufacturer's designations.
- D. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avonite Surfaces.
    - b. E. I. du Pont de Nemours and Company.



- 1 c. Formica Corporation.
- 2 d. LG Chemical, Ltd.
- 3 e. Meganite Inc.
- 4 f. Samsung Chemical USA, Inc.
- 5 g. Swan Corporation (The).
- 6 h. Transolid, Inc.
- 7 i. Wilsonart International.

- 8 2. Colors, Patterns, and Finishes: As indicated by manufacturer's designations.

## 9 2.5 HARDWARE AND ACCESSORIES

- 10 A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- 11 B. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick
- 12 metal, and as follows:
  - 13 1. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- 14 C. Back-Mounted Pulls: BHMA A156.9, B02011.
- 15 D. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- 16 E. Catches: Magnetic catches, BHMA A156.9, B03141.
- 17 F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- 18 G. Shelf Rests: BHMA A156.9, B04013; metal.
- 19 H. Drawer Slides: BHMA A156.9.
  - 20 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-
  - 21 steel ball-bearing slides.
  - 22 2. For drawers not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide,
  - 23 provide Grade 1HD-100.
  - 24 3. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide
  - 25 Grade 1HD-200.
  - 26 4. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide
  - 27 Grade 1HD-200.
- 28 I. Door and Drawer Silencers: BHMA A156.16, L03011.
- 29 J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18
- 30 for BHMA finish number indicated.
  - 31 1. Satin Stainless Steel: BHMA 630.
- 32 K. For concealed hardware, provide manufacturer's standard finish that complies with product class
- 33 requirements in BHMA A156.9.
- 34 2.6 MISCELLANEOUS MATERIALS
- 35 A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less
- 36 than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Contact cement or resorcinol.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.7 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

### 3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.

- 1 F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately  
2 aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered  
3 operation. Complete installation of hardware and accessory items as indicated.

- 4 1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other  
5 variation from a straight line.  
6 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400  
7 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration  
8 into wood framing, blocking, or hanging strips; or No. 10 wafer-head sheet metal screws through  
9 metal backing or metal framing behind wall finish.

- 10 G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into  
11 underside of countertop.

- 12 1. For solid-surface-material countertops, pre-drill holes for screws as recommended by  
13 manufacturer.  
14 2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other  
15 variation from a straight line.

16 3.3 ADJUSTING AND CLEANING

- 17 A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where  
18 not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

- 19 B. Clean, lubricate, and adjust hardware.

- 20 C. Clean cabinets on exposed and semiexposed surfaces.

21 END OF SECTION 064116

1 SECTION 064600 - WOOD TRIM

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes: Architectural woodwork as follows:

- 5 1. Interior standing and running trim.
- 6 2. Closet shelving and clothes rods.
- 7 3. Wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed
- 8 within other construction before woodwork installation.
- 9 4. Shop priming of wood trim.
- 10 5. Shop finishing of wood trim.

11 B. Related Requirements:

- 12 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, and shims required
- 13 for installing wood trim and concealed within other construction before wood trim installation.

14 1.2 DEFINITION

- 15 A. The term "wood trim" as used in this Section refers to trim and other forms of architectural woodwork  
16 specified in this Section.

17 1.3 ACTION SUBMITTALS

- 18 A. Product Data: For each type of product, including panel products and finishing materials and processes.

- 19 B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details,  
20 attachment devices, and other components.

- 21 C. Samples for Initial Selection: Shop-applied transparent finishes.

- 22 D. Samples for Verification: Lumber for transparent finish, not less than 5 inches (125 mm) wide by 24  
23 inches (600 mm) long, for each species and cut, finished on one side and one edge.

24 1.4 INFORMATIONAL SUBMITTALS

- 25 A. Qualification Data: For Installer and fabricator.

- 26 B. Product Certificates: For each type of product.

27 1.5 QUALITY ASSURANCE

- 28 A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to  
29 those required for this Project and whose products have a record of successful in-service performance.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

## 1.7 FIELD CONDITIONS

- A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

- C. Established Dimensions: Where woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

## 1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

## PART 2 - PRODUCTS

## 2.1 WOOD TRIM, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

## 2.2 WOOD TRIM FOR OPAQUE FINISH

- A. Grade: Custom.

- B. Wood Species: Poplar.

## 2.3 CLOSET SHELVING

- A. Grade: Custom.

- B. Shelf Material: 3/4-inch (19-mm) solid lumber.

- 1 C. Cleats: 3/4-inch (19-mm) solid lumber.
- 2 D. Wood Species: Poplar.
- 3 E. Closet Rods: 1-5/16-inch- (33-mm-) diameter, stainless-steel tubes complying with BHMA A156.16,
- 4 L03131.
- 5 F. Rod Flanges: Stainless steel.

#### 6 2.4 WOOD MATERIALS

- 7 A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each
- 8 type of wood trim and quality grade specified unless otherwise indicated.
- 9 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm)
- 10 wide.
- 11 2. Wood Moisture Content for Interior Materials: 5 to 10 percent.

#### 12 2.5 MISCELLANEOUS MATERIALS

- 13 A. Interior Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried
- 14 to less than 15 percent moisture content.
- 15 B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- 16 C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide
- 17 metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip
- 18 galvanized anchors and inserts at inside face of exterior walls and at floors.

#### 19 2.6 FABRICATION

- 20 A. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the
- 21 following:
- 22 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
- 23 B. Complete fabrication, including assembly and hardware application, to maximum extent possible before
- 24 shipment to Project site. Disassemble components only as necessary for shipment and installation.
- 25 Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- 26 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install
- 27 dowels, screws, bolted connectors, and other fastening devices that can be removed after trial
- 28 fitting. Verify that various parts fit as intended and check measurements of assemblies against
- 29 field measurements before disassembling for shipment.
- 30 C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for
- 31 members with ends exposed in finished work.

#### 32 2.7 SHOP PRIMING

- 33 A. Interior Wood Trim for Opaque Finish: Shop prime with one coat of wood primer specified in
- 34 Section 099000 "Painting and Coating."

- 1 B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk  
2 fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to  
3 each unit of work.

- 4 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed  
5 surfaces of wood trim. Apply two coats to surfaces installed in contact with concrete or masonry  
6 and to end-grain surfaces.

7 2.8 SHOP FINISHING

- 8 A. General: Shop finish transparent-finished wood trim at fabrication shop as specified in this Section.  
9 Refer to Section 099000 "Painting and Coating" for field finishing opaque-finished wood trim.

- 10 B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk  
11 fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to  
12 each unit of work.

- 13 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed  
14 surfaces of wood trim. Apply two coats to end-grain surfaces.

- 15 C. Transparent Finish:

- 16 1. Grade: Custom.  
17 2. Finish: System - 5, conversion varnish.  
18 3. Staining: None required.  
19 4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

20 PART 3 - EXECUTION

21 3.1 PREPARATION

- 22 A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

- 23 B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete  
24 work as required, including removal of packing and backpriming.

25 3.2 INSTALLATION

- 26 A. Grade: Install wood trim to comply with same grade as item to be installed.

- 27 B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the  
28 shop.

- 29 C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level  
30 and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

- 31 D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

- 32 E. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with  
33 countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for  
34 exposed fastening, countersunk and filled flush with woodwork.

1. For shop-finished items, use filler matching finish of items being installed.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

G. Touch up finishing work specified in this Section after installation of wood trim. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

### 3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.

B. Clean wood trim on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064600



## SECTION 071113 - BITUMINOUS DAMPPROOFING

**TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.

**Content Requests:**

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**Access Manufacturer-Provided, AIA MasterSpec-Based Sections:**

[<Double click here for this Section based on specific manufacturer's products set as Basis-of-Design at ProductMasterSpec.com.>](#)

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

## A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing.

## B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for bituminous vapor retarders under slabs-on-grade.  
2. Section 042200 "Concrete Unit Masonry" for mortar parge coat on masonry surfaces.

## 1.3 ACTION SUBMITTALS

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

## 1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

1 PART 2 - PRODUCTS

2 2.1 MANUFACTURERS

- 3 A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single  
4 manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

5 2.2 PERFORMANCE REQUIREMENTS

- 6 A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless  
7 otherwise indicated.

8 2.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- 9 A. Trowel Coats: ASTM D1227, Type II, Class 1.

- 10 B. Fibered Brush and Spray Coats: ASTM D1227, Type II, Class 1.

- 11 C. Brush and Spray Coats: ASTM D1227, Type III, Class 1.

12 2.4 AUXILIARY MATERIALS

- 13 A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and  
14 compatible with bituminous dampproofing.

- 15 B. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended  
16 in writing by manufacturer.

- 17 C. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.

- 18 D. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by  
19 dampproofing manufacturer.

20 PART 3 - EXECUTION

21 3.1 EXAMINATION

- 22 A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for  
23 surface smoothness, maximum surface moisture content, and other conditions affecting performance of  
24 the Work.

- 25 B. Proceed with application only after substrate construction and penetrating work have been completed and  
26 unsatisfactory conditions have been corrected.

27 3.2 PREPARATION

- 28 A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-  
29 free, and dry substrates for dampproofing application.

- 1 B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with  
2 dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- 3 C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints,  
4 and remove bond breakers if any.
- 5 D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other  
6 imperfections; cover with asphalt-coated glass fabric.

### 7 3.3 APPLICATION, GENERAL

- 8 A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats,  
9 and drying time before backfilling unless otherwise indicated.
- 10 1. Apply dampproofing to provide continuous plane of protection.  
11 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface  
12 and uninterrupted coverage.
- 13 B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing;  
14 extend over top of footing and down a minimum of 6 inches over outside face of footing.
- 15 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto  
16 surfaces exposed to view when Project is completed.
- 17 2. Install flashings and corner protection stripping at internal and external corners, changes in plane,  
18 construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch-wide  
19 strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for  
20 embedding fabric is in addition to other coats required.
- 21 C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at  
22 least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner  
23 wythe.
- 24 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner  
25 wythe.
- 26 2. Lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.

### 27 3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- 28 A. Unparged Masonry Foundation Walls: Apply primer and one trowel coat at not less than 5 gal./100 sq. ft..
- 29 B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25  
30 gal./100 sq. ft.

### 31 3.5 PROTECTION

- 32 A. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures,  
33 physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and  
34 cannot be concealed and protected by permanent construction immediately after installation.
- 35 B. Correct dampproofing that does not comply with requirements; repair substrates, and reapply  
36 dampproofing.

1    END OF SECTION 071113

## SECTION 072100 - THERMAL INSULATION

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Polyisocyanurate foam-plastic board.
3. Glass-fiber blanket.
4. Mineral-wool board.

## B. Related Requirements:

1. Section 061600 "Sheathing" for composite sheathing with foam-plastic core and plywood facing.
2. Section 074114 "Standing-Seam Metal Roof Panels" for installing board insulation as part of metal panel roof assemblies.
3. Section 075323 "EPDM Roofing" for insulation specified as part of membrane roofing construction.
4. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

## 1.2 ACTION SUBMITTALS

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

## 1.3 INFORMATIONAL SUBMITTALS

## A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

## B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

## 1.4 DELIVERY, STORAGE, AND HANDLING

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

## B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

## PART 2 - PRODUCTS

## 2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD (FPBI-1)

- A. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

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

- a. DiversiFoam Products.
- b. Dow Chemical Company (The).
- c. Owens Corning.
- d. Pactiv Corporation.

## 2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD (FPBI-2)

- A. Polyisocyanurate Board, Glass-Fiber-Mat Faced: ASTM C 1289, glass-fiber-mat faced, Type II, Class 2.

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

- a. Firestone Building Products.
- b. Hunter Panels.
- c. Johns Manville (A Berkshire Hathaway Company).

## 2.3 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

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

- a. CertainTeed Corporation.
- b. Guardian Building Products, Inc.
- c. Johns Manville; a Berkshire Hathaway company.
- d. Knauf Insulation.
- e. Owens Corning.

- B. Glass-Fiber Blanket, Foil Faced: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

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

- a. CertainTeed Corporation.
- b. Guardian Building Products, Inc.
- c. Johns Manville; a Berkshire Hathaway company.
- d. Knauf Insulation.
- e. Owens Corning.

## 2.4 MINERAL-WOOL BOARD

- A. Manufacturer: ROCKWOOL™, 8024 Esquesing Line, Milton, Ontario, L9T 6W3, Phone: 905-878-8474, Toll Free: 1-800-265-6878, e-mail: contactus@rockwool.com, URL: www.rockwool.com
- B. Description: Non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface to ASTM C612 Type IVB
- C. Performance Criteria: Non-combustible, lightweight, water repellent, rigid insulation board with rigid upper surface to ASTM C612 Type IVB.
1. Size: 24 x 48 inches.
  2. Thickness: and weight: 6 inches.
  3. Density:
    - a. Outer layer: 6.24 lb/ft<sup>3</sup> to ASTM C303.
    - b. Inner layer: 3.75 lb/ft<sup>3</sup> to ASTM C303
  4. Acceptable Material: ROCKWOOL™, CAVITYROCK®.

## 2.5 INSULATION FASTENERS

- A. Mechanically Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Products: Use mechanically attached impaling pin recommended by manufacturer of insulation product.
    - a. Provide length to suit depth of insulation.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

## 2.6 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

## 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.

- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.3 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

### 3.4 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

### 3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  - 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
    - a. Exterior Walls: Set units with facing placed toward interior of construction.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.



- 1 3.6 PROTECTION
- 2 A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other
- 3 causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be
- 4 concealed and protected by permanent construction immediately after installation.
- 5 END OF SECTION 072100

1 SECTION 072119 - FOAMED-IN-PLACE INSULATION

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Closed-cell spray polyurethane foam.

- 9 B. Related Requirements:

- 10 1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

11 1.3 ACTION SUBMITTALS

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

13 1.4 INFORMATIONAL SUBMITTALS

- 14 A. Qualification Data: For Installer.

- 15 B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

16 1.5 QUALITY ASSURANCE

- 17 A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

18 PART 2 - PRODUCTS

19 2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

- 20 A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. (24  
21 kg/cu. m) and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

- 22 1. Basis-of-Design Product: Subject to compliance with requirements, provide Carlisle Spray Foam  
23 Insulation; SealTite PRO [Closed Cell] [HFO] [One Zero] or a comparable product by one of the  
24 following:

- 25 a. Gaco; a brand of Firestone Building Products  
26 b. Henry Company

2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - a. Flame-Spread Index: 25 or less.
  - b. Smoke-Developed Index: 450 or less.
3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
4. Compressive Strength: Minimum 30 psi in accordance with ASTM D1621.
5. Air Permeance per 1 inch: Minimum 0.004 cfm/sq. ft. at 1.57 lbf/sq. ft. in accordance with ASTM E2178 and ASTM E2357.
6. Water Vapor Permeance: 1.0 perm or less at 1 inch in accordance with ASTM E96 desiccant method.
7. Dimensional Stability: Less than 9 percent change in volume in accordance with ASTM D2126.

## 2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

### 3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Cavity Walls: Install into cavities to thickness indicated on Drawings.
- F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

- 1    3.3       PROTECTION
- 2       A.    Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other
- 3           causes.
- 4    END OF SECTION 072119

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Self-adhering, vapor-permeable, modified bituminous sheet air barriers.
- B. Related Requirements:
  - 1. Section 072726 "Fluid-Applied Membrane Air Barriers" for fluid-applied air barrier systems.

1.2 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
  - 1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  - 2. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1 B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory  
2 materials with Project materials that connect to or that come in contact with air barrier.

3 C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

#### 4 1.6 QUALITY ASSURANCE

5 A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved  
6 by manufacturer.

7 B. Mockups: Build mockups to set quality standards for materials and execution.

8 1. Provide air barriers as part of freestanding integrated mockups of exterior wall assembly as  
9 indicated on Drawings, integrating thin stone veneer and EIFS, and incorporating backup wall  
10 construction, insulation, ties and other penetrations, and flashing to demonstrate surface  
11 preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations,  
12 and penetrations of air-barrier assembly.

13 a. Coordinate construction of mockups to permit inspection of air barrier before external  
14 insulation and cladding are installed.

15 b. If Architect determines mockups do not comply with requirements, reconstruct mockups  
16 and apply air barrier until mockups are approved.

17 2. Approval of mockups does not constitute approval of deviations from the Contract Documents  
18 contained in mockups unless Architect specifically approves such deviations in writing.

#### 19 1.7 DELIVERY, STORAGE, AND HANDLING

20 A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

21 B. Protect stored materials from direct sunlight.

#### 22 1.8 FIELD CONDITIONS

23 A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures  
24 recommended by air-barrier manufacturer.

25 1. Protect substrates from environmental conditions that affect air-barrier performance.

26 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

### 27 PART 2 - PRODUCTS

#### 28 2.1 MATERIALS, GENERAL

29 A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source  
30 from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 283 ASTM E 783 or ASTM E 2357.

## 2.3 SELF-ADHERING SHEET AIR BARRIER

- A. Vapor-Permeable, Modified Bituminous Sheet: 28-mil (0.71-mm) thick, self-adhering sheet consisting of rubberized asphalt laminated to a cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Grace, W. R. & Co. - Conn.; Perm-A-Barrier VPS.
    - b. Henry Company; Blueskin VP 160.
  2. Physical and Performance Properties:
    - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
    - b. Dry Tensile Strength: Minimum 41 lbf (182 N) machine direction and 29 lbf (129 N) cross direction; ASTM D 828.
    - c. Water Vapor Transmission: 29 Perms (1658 ng/Pa x s x sq. m); ASTM E 96/A, Desiccant Method.

## 2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Counterflashing Strip: Modified bituminous 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil- (0.2-mm-) thick, cross-laminated polyethylene film with release liner backing.
- D. Butyl Strip: Vapor retarding, 30 to 40 mils (0.76 to 1.0 mm) thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.
- E. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.
- F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- G. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

- 1 H. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch (0.5 mm) thick, and Series 300  
2 stainless-steel fasteners.
- 3 I. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam  
4 sealant, 1.5- to 2.0-lb/cu. ft. (24- to 32-kg/cu. m) density; flame-spread index of 25 or less according to  
5 ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant  
6 manufacturer.
- 7 J. Modified Bituminous Transition Strip: Vapor retarding, 40 mils (1.0 mm) thick, smooth surfaced, self-  
8 adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick  
9 polyethylene film with release liner backing.
- 10 K. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- (0.43-mm-) thick, self-adhering strip  
11 consisting of an adhesive coating over a permeable laminate with a permeance value of 37 perms (2145  
12 ng/Pa x s x sq. m).
- 13 1. Basis-of-Design Product: Henry Company; Blueskin Breather.
- 14 L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus),  
15 Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply  
16 with Section 079200 "Joint Sealants."

### 17 PART 3 - EXECUTION

#### 18 3.1 EXAMINATION

- 19 A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and  
20 other conditions affecting performance of the Work.
- 21 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.  
22 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier  
23 manufacturer.  
24 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet  
25 method according to ASTM D 4263.  
26 4. Verify that masonry joints are flush and completely filled with mortar.
- 27 B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 28 3.2 SURFACE PREPARATION

- 29 A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-  
30 free, and dry substrate for air-barrier application.
- 31 B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other  
32 construction.
- 33 C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating  
34 contaminants or film-forming coatings from concrete.
- 35 D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and  
36 other voids in concrete with substrate-patching membrane.



- 1 E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- 2 F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks
- 3 according to ASTM D 4258.
- 4 1. Install modified bituminous strips and center over treated construction and contraction joints and
- 5 cracks exceeding a width of 1/16 inch (1.6 mm).
- 6 G. Bridge and cover isolation joints, expansion joints, and discontinuous wall-to-wall, deck-to-wall, and
- 7 deck-to-deck joints with overlapping modified bituminous strips.
- 8 H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to
- 9 form a smooth transition from one plane to another.
- 10 I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with
- 11 stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air
- 12 barrier.

### 13 3.3 INSTALLATION

- 14 A. General: Install modified bituminous sheets and accessory materials according to air-barrier
- 15 manufacturer's written instructions and according to recommendations in ASTM D 6135.
- 16 1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5
- 17 deg C), install self-adhering, modified bituminous air-barrier sheet produced for low-temperature
- 18 application. Do not install low-temperature sheet if ambient or substrate temperature is higher
- 19 than 60 deg F (16 deg C).
- 20 B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
- 21 1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch (19-mm)
- 22 fillets of termination mastic on horizontal inside corners.
- 23 C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination
- 24 mastic and according to ASTM D 6135.
- 25 D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered
- 26 by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
- 27 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve
- 28 required bond, with adequate drying time between coats.
- 29 E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier.
- 30 Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps.
- 31 Overlap and seal seams, and stagger end laps to ensure airtight installation.
- 32 1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
- 33 2. Roll sheets firmly to enhance adhesion to substrate.
- 34 F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks,
- 35 construction, and contraction joints.

- 1 G. CMU: Install air-barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of  
2 air-barrier sheet immediately below protruding masonry ties or joint reinforcement or ties, and firmly  
3 adhere in place.
- 4 1. Overlap horizontally adjacent sheets a minimum of 2 inches (50 mm) and roll seams.  
5 2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll  
6 firmly into place.  
7 3. Seal around masonry reinforcing or ties and penetrations with termination mastic.  
8 4. Continue the membrane into all openings in the wall, such as doors and windows, and terminate at  
9 points to maintain an airtight barrier that is not visible from interior.
- 10 H. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch- (150-mm-) wide strip of  
11 the following material:
- 12 1. Modified bituminous strip for non-metallic through-wall flashings.  
13 2. Counterflashing strip for metal through-wall flashings.
- 14 I. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal  
15 counterflashings or ending in reglets with termination mastic.
- 16 J. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain  
17 a continuous air barrier.
- 18 1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to  
19 ensure continuity of air barrier with roofing membrane.  
20 2. Install butyl strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of  
21 coverage is achieved over each substrate.
- 22 K. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier,  
23 concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed  
24 curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction  
25 used in exterior wall openings, using accessory materials.
- 26 L. Wall Openings: Prime concealed, perimeter frame surfaces of windows and doors. Apply modified  
27 bituminous transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each  
28 substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less  
29 than 1 inch (25 mm) of full contact.
- 30 1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
- 31 M. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous  
32 penetrations of air-barrier membrane with foam sealant.
- 33 N. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.
- 34 O. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application  
35 temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature  
36 ranges.
- 37 P. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters.  
38 Patch with air-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.
- 39 Q. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

- 1 R. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and  
2 reapply air-barrier components.

3 3.4 FIELD QUALITY CONTROL

- 4 A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance  
5 with requirements. Inspections may include the following:

- 6 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps  
7 or holes.
- 8 2. Air-barrier dry film thickness.
- 9 3. Continuous structural support of air-barrier system has been provided.
- 10 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar  
11 droppings.
- 12 5. Site conditions for application temperature and dryness of substrates have been maintained.
- 13 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
- 14 7. Surfaces have been primed, if applicable.
- 15 8. Laps in strips and transition strips have complied with minimum requirements and have been  
16 shingled in the correct direction (or mastic has been applied on exposed edges), with no  
17 fishmouths.
- 18 9. Termination mastic has been applied on cut edges.
- 19 10. Strips and transition strips have been firmly adhered to substrate.
- 20 11. Compatible materials have been used.
- 21 12. Transitions at changes in direction and structural support at gaps have been provided.
- 22 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for  
23 cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
- 24 14. All penetrations have been sealed.

- 25 B. Tests: As determined by testing agency from among the following tests:

- 26 1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage  
27 according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers or  
28 ASTM E 1186, chamber depressurization using detection liquids.
- 29 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according  
30 to ASTM E 783 or ASTM E 2357.
- 31 3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate  
32 according to ASTM D 4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.

- 33 C. Air barriers will be considered defective if they do not pass tests and inspections.

- 34 1. Apply additional air-barrier material, according to manufacturer's written instructions, where  
35 inspection results indicate insufficient thickness.
- 36 2. Remove and replace deficient air-barrier components for retesting as specified above.

- 37 D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

- 38 E. Prepare test and inspection reports.

39 3.5 CLEANING AND PROTECTION

- 40 A. Protect air-barrier system from damage during application and remainder of construction period,  
41 according to manufacturer's written instructions.

- 1           1.     Protect air barrier from exposure to UV light and harmful weather exposure as required by  
2                     manufacturer. If exposed to these conditions for more than 30 days, or longer period if approved  
3                     by manufacturer, remove and replace air barrier or install additional, full-thickness, air-barrier  
4                     application after repairing and preparing the overexposed membrane according to air-barrier  
5                     manufacturer's written instructions.
- 6           2.     Protect air barrier from contact with incompatible materials and sealants not approved by air-  
7                     barrier manufacturer.
  
- 8        B.     Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using  
9                     cleaning agents and procedures recommended by manufacturer of affected construction.
  
- 10   END OF SECTION 072713

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Vapor-permeable, fluid-applied air barriers.
- B. Related Requirements:
  - 1. Section 072713 "Modified Bituminous Sheet Air Barriers" for sheet air barriers and drainage material.

1.2 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
  - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
  - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  - 3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
  - 1. Provide air barriers as part of freestanding integrated mockups of exterior wall assembly as indicated on Drawings, integrating thin stone veneer and EIFS, and incorporating backup wall construction, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
    - a. Coordinate construction of mockups to permit inspection of air barrier before external insulation and cladding are installed.
    - b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
  - 1. Protect substrates from environmental conditions that affect air-barrier performance.
  - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 2357.

## 2.3 HIGH-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. High-Build, Vapor-Permeable Air Barrier: Modified bituminous or synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils (0.9 mm) or thicker over smooth, void-free substrates.

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

- a. Carlisle Coatings & Waterproofing Inc; Fire Resist Barritech VP.
- b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier VP.

## 2. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
- b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m); ASTM E 96/E 96M, Desiccant Method, Procedure A.
- c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
- d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D 4541.
- e. UV Resistance: Can be exposed to sunlight for 30 days according to manufacturer's written instructions.

## 2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch (0.5 mm) thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

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

- 1 a. Dow Corning Corporation; Dow Corning® 123 Silicone Seal.
- 2 b. GE Construction Sealants; Momentive Performance Materials Inc.; US11000 UltraSpan.
- 3 c. Pecora Corporation; Sil-Span.
- 4 d. Tremco Incorporated; Spectrem Simple Seal.

## 5 PART 3 - EXECUTION

### 6 3.1 EXAMINATION

- 7 A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and  
8 other conditions affecting performance of the Work.
  - 9 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  - 10 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-  
11 barrier manufacturer.
  - 12 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary  
13 moisture by plastic sheet method according to ASTM D 4263.
  - 14 4. Verify that masonry joints are flush and completely filled with mortar.
- 15 B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 16 3.2 SURFACE PREPARATION

- 17 A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's  
18 written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- 19 B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other  
20 construction.
- 21 C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating  
22 contaminants or film-forming coatings from concrete.
- 23 D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and  
24 other voids in concrete with substrate-patching material.
- 25 E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- 26 F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to  
27 form a smooth transition from one plane to another.
- 28 G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with  
29 stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air  
30 barrier.
- 31 H. Bridge isolation joints, expansion joints, and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck  
32 joints with air-barrier accessory material that accommodates joint movement according to manufacturer's  
33 written instructions and details.

### 34 3.3 ACCESSORIES INSTALLATION

- 35 A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form  
36 a seal with adjacent construction and ensure continuity of air and water barrier.



1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
  3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion, as recommended by air barrier manufacturer, so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.
1. Transition Strip: Roll firmly to enhance adhesion.
  2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.
- 3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION
- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.

2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils (0.9 mm), applied in one or more equal coats.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.5 FIELD QUALITY CONTROL

A. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.
8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

B. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers or ASTM E 1186, chamber depressurization using detection liquids.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.

C. Air barriers will be considered defective if they do not pass tests and inspections.

- 1 1. Apply additional air-barrier material, according to manufacturer's written instructions, where
- 2 inspection results indicate insufficient thickness.
- 3 2. Remove and replace deficient air-barrier components for retesting as specified above.
- 4 D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- 5 E. Prepare test and inspection reports.

### 6 3.6 CLEANING AND PROTECTION

- 7 A. Protect air-barrier system from damage during application and remainder of construction period,
- 8 according to manufacturer's written instructions.
- 9 1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in
- 10 writing by manufacturer. If exposed to these conditions for longer than recommended, remove
- 11 and replace air barrier or install additional, full-thickness, air-barrier application after repairing
- 12 and preparing the overexposed materials according to air-barrier manufacturer's written
- 13 instructions.
- 14 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-
- 15 barrier manufacturer.
- 16 B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using
- 17 cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- 18 C. Remove masking materials after installation.

19 END OF SECTION 072726

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### SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

**TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

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Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

### 1.2 SUMMARY

A. Section Includes:

1. Standing-seam metal roof panels.

B. Related Sections:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Section 074213.23 Metal Composite Material Wall Panels for metal panels used in horizontal soffit applications.
2. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

### 1.3 PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

- A. Preinstallation Conference: Conduct conference at Project site.

If needed, insert list of conference participants not mentioned in Section 13100 "Project Management and Coordination."

Retain subparagraphs below if additional requirements are necessary; revise to include more specific information about conference.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

### 1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

- B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs for two-stage Samples.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

#### 1.5 INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

#### 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

Retain "UL-Certified, Portable Roll-Forming Equipment" Paragraph below if portable roll-forming equipment is allowed for on-site roll forming.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

Retain first subparagraph below for large-scale mockup. Indicate portion of roof represented by mockup on Drawings or draw mockup as separate element.

Retain first subparagraph below for limited mockups.

1. Build mockups for typical roof area only, including accessories.

a. Size: 12 feet long by 6 feet.

b. Each type of exposed seam and seam termination.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

Retain subparagraph below if the intention is to make an exception to the default requirement in Section 014000 "Quality Requirements" for demolishing and removing mockups.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

#### 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

#### 1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.11 WARRANTY

When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.
- b. Deterioration of metals and other materials beyond normal weathering.

Verify available warranties and warranty periods for metal panels.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

Usually retain "Exposed Panel Finish" Subparagraph below for fluoropolymer or siliconized-polyester finishes; verify availability with manufacturer.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

Verify available warranties for metal panel finishes and insert number in "Finish Warranty Period" Subparagraph below. A 20-year period is available for fluoropolymer finish and is the maximum included with manufacturers' published data; a 10-year period is usually available for siliconized polyester. Longer periods for premium finishes may be available.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

Verify availability of warranty in "Special Weathertightness Warranty" Paragraph below; only a few manufacturers, for a limited number of products, offer a weathertightness warranty.

## PART 2 - PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

### 2.1 PERFORMANCE REQUIREMENTS

Retain first "Energy Performance" Paragraph below for roofs that must comply with the EPA/DOE's ENERGY STAR requirements. The EPA/DOE's ENERGY STAR "Roof Product List" is available in PDF at [www.energystar.gov](http://www.energystar.gov).

Retain "Energy Performance" Paragraph below for roofs that must comply with local "cool-roof" energy legislation; verify requirements with authorities having jurisdiction. Example and options below are for low-slope roofs that must comply with prescriptive approach of CCR Title 24 (California Building Standards Code).

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

- 1. Wind Loads: As indicated on Drawings.
- 2. Other Design Loads: As indicated on Drawings.
- 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.



1 Retain "Air Infiltration" and "Water Penetration under Static Pressure" paragraphs below for single-skin metal  
2 panels that span openings between supports; usually delete for panels mounted on solid substrates.

3 ASTM E1680 in "Air Filtration" Paragraph below has replaced ASTM E283 for testing metal roof panels; retain  
4 option to allow products to be tested according to ASTM E283.

5 B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 at  
6 the following test-pressure difference:

7 Value in first option in "Test-Pressure Difference" Subparagraph below is equivalent to a 25-mph (40-km/h) wind  
8 and is ASTM E1680 default. Products tested to value in second option below, equivalent to a 50-mph (80-km/h)  
9 wind, are widely available. Revise to suit Project.

10 1. Test-Pressure Difference: 6.24 lbf/sq. ft.

11 ASTM E1646 in "Water Penetration under Static Pressure" Paragraph below has replaced ASTM E331 for testing  
12 metal roof panels; retain option to allow products to be tested according to ASTM E331.

13 C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 at  
14 the following test-pressure difference:

15 Value in first option in "Test-Pressure Difference" Subparagraph below is equivalent to a 34-mph (55-km/h) wind  
16 and is ASTM E1646 default. Products tested to value in second option below, equivalent to a 50-mph wind (80-  
17 km/h), are widely available. Revise to suit Project.

18 1. Test-Pressure Difference: 6.24 lbf/sq. ft.

19 Test in "Hydrostatic-Head Resistance" Paragraph below is for resistance to hydrostatic pressure from standing  
20 water. Retain only for panels capable of watertight (hydrostatic) installation, not for panels used in water-shedding  
21 (hydrokinetic) installations that rely on underlayment for watertightness.

22 D. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.

23 Retain "Wind-Uplift Resistance" Paragraph below if UL-class roof is required. Verify that product is listed in UL's  
24 "Roofing Materials & Systems Directory." UL listings include requirements for the entire assembly and not solely  
25 the metal roof panels.

26 E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-  
27 resistance class indicated.

28 The higher the value in the options in "Uplift Rating" Subparagraph below, the greater the uplift resistance.

29 1. Uplift Rating: UL 90.

30 Retain "FM Global Listing" Paragraph below if Project is FM Global insured or if FM Global requirements will set  
31 a minimum quality standard. Coordinate requirements of FM Global classification with other requirements in this  
32 Section. Verify availability of metal roof panel systems that meet these classifications.

33 F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by  
34 preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of  
35 connections, and other detrimental effects. Base calculations on surface temperatures of materials due to  
36 both solar heat gain and nighttime-sky heat loss.

37 Differential values (for aluminum in particular) in "Temperature Change (Range)" Subparagraph below are suitable  
38 for most of the U.S.; revise to suit Project.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material.

## 2.2 STANDING-SEAM METAL ROOF PANELS

- A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

Copy paragraphs below and re-edit for each product.

Insert drawing designation for each product required. Use these designations on Drawings to identify each product.

- A. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.

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

- a. Berridge Manufacturing Company; Zee-Lock Panel.
- b. Centria, SRS 3 Panel.
- c. Pac-Clad; PAC-150 90 degree Single Lock (smooth panel).

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755.

- a. Nominal Thickness: 0.024 inch.
- b. Exterior Finish: Two-coat fluoropolymer.
- c. Colors: As follows, for types corresponding with designations on Drawings:

- 1) SMF-1: Custom color to match Architect' sample.

3. Clips: Two-piece floating to accommodate thermal movement.

- a. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.

- 4. Joint Type: Single folded.
- 5. Panel Coverage: 16 inches.
- 6. Panel Height: 1.5 inches, 2.0 inches or 3.0 inch.

## 2.3 UNDERLAYMENT MATERIALS

Retain appropriate paragraphs in this article for metal roof panels applied over sheathing. Self-adhering, high-temperature underlayment may be applied only at eaves, valleys, and other areas vulnerable to leakage, with felt applied over the remainder of the roof; or underlayment may be applied over the entire roof area.

Underlayments listed in "Self-Adhering, High-Temperature Underlayment" Paragraph below are suitable for higher temperatures associated with metal roofing. Revise if high-temperature underlayments are not required. Verify, with underlayment manufacturer, acceptability for use on roofs with slopes less than 2:12.

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.

Retain "Felt Underlayment" Paragraph below if not using self-adhering, high-temperature underlayment over the entire roof area.

- B. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felts.

Sheet in "Slip Sheet" Paragraph below is used to separate metal roof panels from underlayment. Retain if required by manufacturer.

- C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

Retain panel accessories, flashing, and trim as required and coordinate with those specified in Section 076200 "Sheet Metal Flashing and Trim."

- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

If required, insert special requirements for ridge closures, corner units, copings, fasciae, and fillers.

- D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a

maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot-long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Roof Curbs: Fabricated from same material as roof panels, **0.048-inch** nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch-nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

1. Insulate roof curb with 1-inch-thick, rigid insulation.

G. Panel Fasteners: Self-tapping screws designed to withstand design loads.

H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

## 2.5 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

[Retain "On-Site Fabrication" Paragraph below to permit use of on-site, portable roll-forming equipment.](#)

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

[Retain first paragraph below if gaskets or sealants are factory installed.](#)

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
- a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

## 2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### C. Steel Panels and Accessories:

Retain one exposed fluoropolymer or siliconized-polyester finish from subparagraphs below. Verify availability of finishes for products specified. If retaining more than one, indicate location of each on Drawings or by inserts. To obtain a proprietary finish system, insert names of coating manufacturers and products.

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Finish in "Concealed Finish" Subparagraph below is frequently used as a factory finish for interior surfaces.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

Retain one or both subparagraphs below.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

Retain subparagraph below with subparagraph above for systems that depend on air- or water-resistive barriers to prevent air infiltration or water penetration.

- a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

### 3.3 INSTALLATION OF UNDERLAYMENT

Retain this article for metal roof panels applied over solid roof sheathing.

Retain "Self-Adhering Sheet Underlayment" or "Felt Underlayment" Paragraph below or retain both if required.

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

Retain one of two subparagraphs below or delete both if indicated on Drawings.

1. Apply over the entire roof surface.

Retain "Slip Sheet" Paragraph below if required.

- B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

- C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

### 3.4 INSTALLATION OF STANDING SEAM METAL ROOF PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
4. Stainless Steel Panels: Use stainless steel fasteners.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

Retain "Snap Joint" or "Seamed Joint" Subparagraph below; coordinate with products selected in Part 2.

3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

Retain "Watertight Installation" Subparagraph below for hydrostatic (watertight) panel installation; delete if not required.

5. Watertight Installation:

- a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
- b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
- c. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

Retain "Clipless Metal Panel Inspection" Paragraph below if retaining "Clipless, Integral-Standing-Seam Metal Roof Panels" Paragraph in Part 2.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types



indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

- H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

- I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

Retain one of two subparagraphs below.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

- J. Roof Curbs: Install flashing around bases where they meet metal roof panels.

- K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

### 3.5 ERECTION TOLERANCES

Generally, retain this article only for sophisticated or highly finished metal roof panel assemblies.

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

If less-stringent tolerances are required, consider inserting installation tolerances from MCA's "Guide Specification for Residential Metal Roofing."

### 3.6 FIELD QUALITY CONTROL

Retain "Manufacturer's Field Service" Paragraph below to require a factory-authorized service representative to perform tests and inspections.

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.



- 1 B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do  
2 not comply with specified requirements.
- 3 C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of  
4 replaced or additional work with specified requirements.
- 5 D. Prepare test and inspection reports.

6 3.7 CLEANING AND PROTECTION

- 7 A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless  
8 otherwise indicated in manufacturer's written installation instructions. On completion of metal panel  
9 installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean  
10 condition during construction.
- 11 B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish  
12 touchup or similar minor repair procedures.

13 END OF SECTION 074113.16

SECTION 074213.19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

1.2 SUMMARY

- A. Section Includes:

1. Foamed-insulation-core metal wall panels.

- B. Related Requirements:

Retain subparagraph below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.

1.3 PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

- A. Preinstallation Conference: Conduct conference at Project site.

If needed, insert list of conference participants not mentioned in Section 13100 "Project Management and Coordination."

Retain subparagraphs below if additional requirements are necessary; revise to include more specific information about conference.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

#### 1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

##### B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs below for two-stage Samples.

##### C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

##### D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

#### 1.5 INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

##### A. Qualification Data: For Installer.

##### B. Product Test Reports: For each product, tests performed by a qualified testing agency.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

#### 1.6 CLOSEOUT SUBMITTALS

##### A. Maintenance Data: For metal panels to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

##### A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

Retain first subparagraph below for large-scale mockup. Indicate portion of building represented by mockup on Drawings or draw mockup as separate element. Revise to suit Project or if larger mockup is needed for field performance testing.

1. Build mockup of typical metal panel assembly as shown on Drawings, including supports, attachments, and accessories.
2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.

Retain first subparagraph below if mockups are not only for establishing appearance factors.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

Retain subparagraph below if the intention is to make an exception to the default requirement in Section 014000 "Quality Requirements" for demolishing and removing mockups.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

#### 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

#### 1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.11 WARRANTY

When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.
- b. Deterioration of metals and other materials beyond normal weathering.

Verify available warranties and warranty periods for metal panels.

2. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

Usually retain "Exposed Panel Finish" Subparagraph below for fluoropolymer or siliconized-polyester finishes; verify availability with manufacturer.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

Verify available warranties for metal panel finishes and insert number in "Finish Warranty Period" Subparagraph below. A 20-year period is available for fluoropolymer finish and is the maximum included with manufacturers' published data; a 10-year period is usually available for siliconized polyester. Longer periods for premium finishes may be available.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

Insert requirements for special weathertightness warranty if needed. Panel manufacturers do not typically offer such warranties on wall systems.

## PART 2 - PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

### 2.1 MANUFACTURER

A. Basis of Design Manufacturer: Metl-Span, a Nucor company; Lewisville, Texas Tel: 972.221.6656; Email: info@metlspan.com; Web: metlspan.com

B. Provide basis of design product or comparable product approved by Architect prior to bid.

### 2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E72:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

Value in first option in "Test-Pressure Difference" Subparagraph below is equivalent to a 25-mph (40-km/h) wind and is ASTM E283 default. Products tested to value in second option below, equivalent to a 50-mph (80-km/h) wind, are widely available. Revise to suit Project.

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

ASTM E331, in "Water Penetration under Static Pressure" Paragraph below, indicates that "water contained within drainage flashings, gutters, and sills is not considered failure."

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

Value in first option in "Test-Pressure Difference" Subparagraph below is equivalent to a 34-mph (55-km/h) wind and is ASTM E331 default. Products tested to value in second option below, equivalent to a 50-mph wind (80-km/h), are widely available. Revise to suit Project.

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Differential values (for aluminum in particular) in "Temperature Change (Range)" Subparagraph below are suitable for most of the U.S.; revise to suit Project.

1. Temperature Change (Range): 120 deg F, ambient.

## 2.3 FOAMED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.

- a. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
- b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D1622.
- c. Compressive Strength: Minimum 20 psi when tested according to ASTM D1621.
- d. Shear Strength: 26 psi when tested according to ASTM C273/C273M.

Copy paragraphs below and re-edit for each product.

Insert drawing designation for each product required. Use these designations on Drawings to identify each product.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels (IMWP-1): Structural metal panel consisting of flush, smooth exterior metal sheet, and interior metal sheet with a Light Mesa profile, with

factory foamed-in-place polyurethane core in thermally-separated profile, with tongue-and-groove panel edges, attached to supports using concealed fasteners.

1. Basis of Design: Metl-Span, CF Architectural.
2. G-90 galvanized coated steel conforming to ASTM A 653 or AZ-50 aluminum-zinc alloy coated steel, conforming to ASTM A 792/A 792M, minimum grade 33, pre-painted by the coil-coating process per ASTM A 755/A 755M.
  - a. Exterior Face Sheet: 22 gauge thickness, with smooth unembossed surface.
  - b. Exterior Finish: Fluoropolymer two-coat system.
    - 1) Color: As selected by Architect from manufacturer's full range.
  - c. Interior Face Sheet: 24 gauge thickness, with stucco-embossed Light Mesa profile.
  - d. Interior Finish: Polyester two-coat system.
    - 1) Color A: As selected by Architect from manufacturer's full range.
    - 2) Color B: As selected by Architect from manufacturer's full range.

Retain "Backer Board" Subparagraph below if required. A backer board provides additional impact resistance.

3. Panel Coverage: 30 inches and 24 inches nominal in pattern indicated on drawings.
4. Panel Thickness: 3.0 inches.

Coordinate R-value in "Thermal-Resistance Value (R-Value)" Subparagraph below with thickness retained in "Panel Thickness" Subparagraph above.

5. Thermal-Resistance Value (R-Value): 26.2 per ASTM C 518 at 35 degrees Fahrenheit mean temperature.

- C. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels (**IMWP-2**): Structural metal panels consisting of exterior metal sheet and interior metal sheet with matching 4 by 1/8 inch o.c. profile. Factory foamed-in-place polyurethane core in thermally-separated profile, with tongue-and-groove panel edges, attached to supports using concealed fasteners.

1. Basis of Design: Metl-Span, CF Mesa Wall Panel.
2. G-90 galvanized coated steel conforming to ASTM A 653 or AZ-50 aluminum-zinc alloy coated steel, conforming to ASTM A 792/A 792M, minimum grade 33, pre-painted by the coil-coating process per ASTM A 755/A 755M.
  - a. Exterior Face Sheet: 24 gauge thickness, with smooth unembossed surface.
  - b. Exterior Finish: Fluoropolymer two-coat system.
    - 1) Color: As selected by Architect from manufacturer's full range.
  - c. Interior Face Sheet: 26 gauge thickness, with stucco-embossed Light Mesa profile.
  - d. Interior Finish: Polyester two-coat system.
    - 1) Color: As selected by Architect from manufacturer's full range.

Retain "Backer Board" Subparagraph below if required. A backer board provides additional impact resistance.

3. Panel Width: 42 inches.
4. Panel Thickness: 3.0 inches. Panel thickness measured from inside skin to top of high cell.

Coordinate R-value in "Thermal-Resistance Value (R-Value)" Subparagraph below with thickness retained in "Panel Thickness" Subparagraph above.

5. Thermal-Resistance Value (R-Value): 26.9 per ASTM C 518 at 35 degrees Fahrenheit mean temperature.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

Retain panel accessories, flashing, and trim as required and coordinate with those specified in Section 076200 "Sheet Metal Flashing and Trim."

- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

Retain "Backer Board" Paragraph below to provide increased impact resistance. Revise to insert other backer boards such as plywood if required.

- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

Insert requirements for explosion-relief panels, including special fasteners, cables, and supports, if required. Verify availability with manufacturers.

- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.



## 2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

Retain first paragraph below if gaskets or sealants are factory installed.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

- a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

Retain one exposed fluoropolymer or siliconized-polyester finish from subparagraphs below. Verify availability of finishes for products specified. If retaining more than one, indicate location of each on Drawings or by inserts. To obtain a proprietary finish system, insert names of coating manufacturers and products.

1. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Finish in "Concealed Finish" Subparagraph below is frequently used as a factory finish for interior surfaces.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

D. Aluminum Panels and Accessories:

Retain one fluoropolymer, siliconized-polyester, or anodized finish from subparagraphs below. Verify availability of finishes for products specified. If retaining more than one, indicate location of each on Drawings or by inserts. To obtain a proprietary finish system, insert names of coating manufacturers and products.

Revise or insert additional testing requirements in five fluoropolymer subparagraphs below if performance levels indicated in AAMA 2605 are insufficient. See Evaluations.

1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

Retain one or both subparagraphs below.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

Retain subparagraph below with subparagraph above for systems that depend on air- or water-resistive barriers to prevent air infiltration or water penetration.

- a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

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

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

## 3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.

[Retain subparagraph below if joint-sealant work is part of this Section.](#)

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

## 3.4 INSULATED METAL WALL PANEL INSTALLATION

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.

5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.

Retain subparagraph below if required; coordinate with products retained in Part 2.

7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.

- B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.

1. Install clips to supports with self-tapping fasteners.

- C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

- D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

### 3.5 FIELD QUALITY CONTROL

Retain "Testing Agency" Paragraph below to identify who shall perform tests and inspections. If retaining second option below, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article.

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

Retain "Water-Spray Test" Paragraph below to check system's resistance to water penetration. Revise indicated test-area requirements to suit Project.

- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

Retain "Manufacturer's Field Service" Paragraph below to require a factory-authorized service representative to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Metal wall panels will be considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

### 3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.19

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### SECTION 074213.23 - METAL COMPOSITE MATERIAL WALL PANELS

**TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.

**Content Requests:**

[<Double click here to submit questions, comments, or suggested edits to this Section.>](#)

**Access Manufacturer-Provided, AIA MasterSpec-Based Sections:**

[<Double click here for this Section based on specific manufacturer's products set as Basis-of-Design at ProductMasterSpec.com.>](#)

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

### 1.2 SUMMARY

- A. Section includes metal composite material wall panels.

### 1.3 PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

## 1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

## B. Shop Drawings:

1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.

Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs below for two-stage Samples.

## C. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

## D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Composite Material Panels: 12 inches long by 12 inch wide. Include fasteners, closures, and other metal composite material panel accessories.

## 1.5 INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

## A. Qualification Data: For Installer.

## B. Product Test Reports: For each product, tests performed by a qualified testing agency.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

## C. Field quality-control reports.

## D. Sample Warranties: For special warranties.

## 1.6 CLOSEOUT SUBMITTALS

## A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

## A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

Retain first subparagraph below for large-scale mockup. Indicate portion of building represented by mockup on Drawings or draw mockup as separate element. Revise to suit Project or if larger mockup is needed for field performance testing.

1. Build mockup of typical metal composite material panel assembly as shown on Drawings, including supports, attachments, and accessories.
2. Water-Spray Test: Conduct water-spray test of mockup of metal composite material panel assembly, testing for water penetration according to AAMA 501.2.

Retain first subparagraph below if mockups are not only for establishing appearance factors.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

Retain subparagraph below if the intention is to make an exception to the default requirement in Section 014000 "Quality Requirements" for demolishing and removing mockups.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
- B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal composite material panels during installation.

#### 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

#### 1.10 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.



1.11 WARRANTY

When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.  
b. Deterioration of metals and other materials beyond normal weathering.

Verify available warranties and warranty periods for metal composite material panels.

2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

Usually retain "Exposed Panel Finish" Subparagraph below for fluoropolymer finish; verify availability with manufacturer.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D2244.  
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.  
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

Verify available warranties for metal composite material panel finishes and insert number in "Finish Warranty Period" Subparagraph below. A 20-year period is available for fluoropolymer finish and is the maximum included with manufacturers' published data. Longer periods for premium finishes may be available.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

Insert requirements for special weathertightness warranty if needed; panel manufacturers do not typically offer such warranties on wall systems.

PART 2 - PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:

1. Wind Loads:  
a. Basic Wind Speed (3 second gust): 128 mph  
b. Risk Category: IV

- c. Wind Exposure Category: Exposure C
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Differential values (for aluminum in particular) in "Temperature Change (Range)" Subparagraph below are suitable for most of the U.S.; revise to suit Project.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

Retain "Fire-Resistance Ratings" Paragraph below only if products specified are part of a fire-resistance-rated assembly. Indicate rating, testing agency, and testing agency's design designation on Drawings.

Retain "Fire Propagation Characteristics" Paragraph below if required. Tested products are not available from all manufacturers.

## 2.2 METAL COMPOSITE MATERIAL WALL PANELS (MCMWP)

Copy this article re-edit for each product.

Insert drawing designation. Use these designations on Drawings to identify each product.

- A. Metal Composite Material Wall Panel Systems (MCMWP): Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, and accessories required for weathertight system.

1. Basis-of-Design product: BAMCO Inc. 30 Baekeland Ave, Middlesex, NJ 08846, (800-245-0210 or 732-3020889) [www.bamcoinc.org](http://www.bamcoinc.org)
  - a. Manufacturers: Subject to compliance with requirements, products may be provided by one of the following:
    - 1) Alucobond USA:
      - a) Wet Sealed Alucobond Plus
    - 2) PAC-CLAD/Petersen Aluminum
      - a) PAC-3000 CS

- B. Aluminum-Faced Composite Wall Panels: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials. The core material shall be free of voids and/or air spaces and not contain foamed insulation material. Products laminated sheet by sheet in a batch process using glues or adhesives between materials shall not be acceptable. All panels corners shall be routed/folded reinforced with structural sealant and reinforced with angles or extrusions. Panel edges shall have rivets at exposed panel edges. Formed with 0.0197-inch-thick, aluminum sheet facings.

1. Panel Thickness: .157 inch.
2. Core: Standard.
3. Coil coated KYNAR® 500 in conformance with the following general requirements of AAMA 2605.
  - a. Color: Match Architect's samples.

## 4. Acceptable raw material manufacturers:

- a. ALUCOBOND material manufactured by 3A Composites USA, Inc. 208 West 5<sup>th</sup> Street, Benton, KY 42025 (800-626-3365 or 270-527-4200)
- b. REYNOBOND PE material manufactured by Alcoa Architectural Products (USA), 50 Industrial Boulevard, Eastman, Georgia 31023 (800-841-7774 or 478-374-4746)
- c. ALPOLIC material manufactured by Mitsubishi Chemical FP America Inc, 401 Volvo Parkway, Chesapeake, Virginia, 23320 (800-422-7270 or 757-548-7826)

Retain first option in "Attachment Assembly Components" Paragraph below with aluminum-faced panels; retain second option with copper-faced panels.

C. Attachment Assembly Components: Formed from extruded aluminum.

D. Attachment Assembly: Manufacturer's standard.

## 2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.

Retain panel accessories, flashing and trim as required and coordinate with those specified in Section 076200 "Sheet Metal Flashing and Trim."

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

## 2.4 FABRICATION

A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

Retain first paragraph below if gaskets or sealants are factory installed.

- 1 B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips  
2 that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from  
3 movements.
- 4 C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's  
5 recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to  
6 design, dimensions, metal, and other characteristics of item indicated.
- 7 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool  
8 marks and that are true to line and levels indicated, with exposed edges folded back to form hems.  
9 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal  
10 with epoxy seam sealer. Rivet joints for additional strength.  
11 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams.  
12 Tin edges to be seamed, form seams, and solder.  
13 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to  
14 comply with SMACNA standards.  
15 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on  
16 faces of accessories exposed to view.  
17 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from  
18 compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
- 19 a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall  
20 panel manufacturer for application but not less than thickness of metal being secured.

## 21 2.5 FINISHES

- 22 A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable,  
23 temporary protective covering before shipping.
- 24 B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if  
25 they are within one-half of the range of approved Samples. Noticeable variations in same piece are not  
26 acceptable. Variations in appearance of other components are acceptable if they are within the range of  
27 approved Samples and are assembled or installed to minimize contrast.
- 28 C. Aluminum Panels and Accessories:

29 Retain one fluoropolymer or anodized finish from subparagraphs below. Verify availability of finishes for products  
30 specified. If retaining more than one, indicate location of each on Drawings or by inserts. To obtain a proprietary  
31 finish system, insert names of coating manufacturers and products.

32 Revise or insert additional testing requirements in five fluoropolymer subparagraphs below if performance levels  
33 indicated in AAMA 2605 are insufficient.

- 34 1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent  
35 PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to  
36 exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

37 Retain one of two options in "Clear Anodic Finish" Subparagraph below. Class I finish is heavy anodized. Verify  
38 availability with manufacturers.

39 Retain one of two options in "Color Anodic Finish" Subparagraph below. Verify availability with manufacturers.

40 Retain "Copper Panels and Accessories" Paragraph below for prepatinated copper panels; delete if retaining only  
41 mill finish.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.

Retain one or both subparagraphs below.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.

Retain subparagraph below with subparagraph above for systems that depend on air- or water-resistive barriers to prevent air infiltration or water penetration.

- a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.

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

## 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite material panel manufacturer's written recommendations.

## 3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite material panels.
2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fasteners in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal composite material panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
2. Copper Panels: Use copper, stainless-steel or hardware-bronze fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

Usually retain "Attachment Assembly, General" Paragraph below with either "Installation" Paragraph or one of "Clip Installation," "Subgirt-and-Spline Installation," "Track-Support Installation," or "Rainscreen-Principle Installation" paragraphs below.

D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

Retain "Installation" Paragraph below for manufacturer's standard installation method, or delete and retain one of "Clip Installation," "Subgirt-and-Spline Installation," "Track-Support Installation," or "Rainscreen-Principle Installation" paragraphs.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
2. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
3. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.

F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.

1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
2. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.

"Subgirt-and-Spline Installation" Paragraph below describes Firestone's "UNA-FAB Series 1500" panels.

G. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical tracks that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through

1 drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with  
2 manufacturer's standard "T" clips.

3 Retain one of first two subparagraphs below.

4 1. Attach routed-and-turned flanges of wall panels to perimeter extrusions with manufacturer's  
5 standard fasteners.

6 First subparagraph below describes Alcoa's "Reynobond" panels.

7 2. Install wall panels to allow individual panels to "free float" and be installed and removed without  
8 disturbing adjacent panels.

9 3. Do not apply sealants to joints unless otherwise indicated.

10 H. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting,  
11 and provide for thermal expansion. Coordinate installation with flashings and other components.

12 1. Install components required for a complete metal composite material panel assembly including  
13 trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar  
14 items. Provide types indicated by metal composite material panel manufacturer; or, if not  
15 indicated, provide types recommended in writing by metal composite material panel manufacturer.

16 I. Flashing and Trim: Comply with performance requirements, manufacturer's written installation  
17 instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where  
18 possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are  
19 permanently watertight.

20 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line  
21 and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing  
22 and trim to fit substrates and to result in waterproof performance.

23 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space  
24 movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or  
25 intersection. Where lapped expansion provisions cannot be used or would not be sufficiently  
26 waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled  
27 with mastic sealant (concealed within joints).

#### 28 3.4 ERECTION TOLERANCES

29 A. Installation Tolerances: Shim and align metal composite material wall panel units within installed  
30 tolerance of 1/4 inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and  
31 within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

#### 32 3.5 FIELD QUALITY CONTROL

33 Retain "Testing Agency" Paragraph below to identify who shall perform tests and inspections. If retaining second  
34 option, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article.

35 Retain "Water-Spray Test" Paragraph below to check system's resistance to water penetration. Revise indicated test-  
36 area requirements to suit Project.

37 Retain "Manufacturer's Field Service" Paragraph below to require a factory-authorized service representative to  
38 perform tests and inspections.

- 1 A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect  
2 completed metal composite material wall panel installation, including accessories.

3 See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300  
4 "Execution" for requirements for correcting the Work.

- 5 B. Metal composite material wall panels will be considered defective if they do not pass test and inspections.

- 6 C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of  
7 replaced or additional work with specified requirements.

- 8 D. Prepare test and inspection reports.

9 3.6 CLEANING AND PROTECTION

- 10 A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels  
11 are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion  
12 of metal composite material panel installation, clean finished surfaces as recommended by metal  
13 composite material panel manufacturer. Maintain in a clean condition during construction.

- 14 B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions,  
15 dirt, and sealant.

- 16 C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful  
17 repair by finish touchup or similar minor repair procedures.

18 END OF SECTION 074213.23



## SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
2. Roof insulation.

## B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Division 22 Sections for roof drains.

## 1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

## 1.3 PREINSTALLATION MEETINGS

## A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

## 1.4 ACTION SUBMITTALS

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

## B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacings and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
5. Roof Expansion Joints:

- a. Include plans, elevations, sections, and attachment details.
- b. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
- c. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Walkway pads, of color required.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Global approved for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

## 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
  - 2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
  - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system, and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-90.

2. Hail-Resistance Rating: MH.

### 2.3 EPDM ROOFING

A. EPDM: ASTM D 4637, Type II, scrim or fabric internally reinforced, uniform, flexible EPDM sheet.

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

a. Carlisle SynTec Incorporated.

b. Firestone Building Products.

c. Johns Manville; a Berkshire Hathaway company.

2. Thickness: 60 mils (1.5 mm), nominal.

3. Exposed Face Color: White on black.

### 2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard.

D. Seaming Material: Single-component, butyl splicing adhesive and splice cleaner or manufacturer's standard, synthetic-rubber polymer primer and 6-inch (150-mm) wide minimum, butyl splice tape with release film.

E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

G. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

1. Provide white flashing accessories for white EPDM membrane roofing.

## 2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Global-approved roof insulation.

- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

- C. Tapered Insulation: Material: **[Match roof insulation]** <Insert material>.

1. Minimum Thickness: 1/4 inch.  
2. Slope:

- a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.

- b. Saddles and Crickets: **[1/2 inch per foot (1:24)]** <Insert slope> unless otherwise indicated on Drawings Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.

## 2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

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

### 3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

### 3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

### 3.4 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
  1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- G. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
2. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

### 3.5 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
- E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.
- F. Apply roofing with side laps shingled with slope of roof deck where possible.
- G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
  1. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
- I. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
- J. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.

### 3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

- 1 E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars  
2 unless otherwise indicated.

3 3.7 WALKWAY INSTALLATION

- 4 A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to  
5 substrate with compatible adhesive according to roofing system manufacturer's written instructions.

6 3.8 FIELD QUALITY CONTROL

- 7 A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation,  
8 membrane application, flashings, protection, and drainage components, and to furnish reports to  
9 Architect.

- 10 B. EFVM Testing: Engage a qualified EFVM testing agency to survey entire roof area for potential leaks  
11 using electric field vector mapping (EFVM).

- 12 C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing  
13 installation on completion.

- 14 D. Repair or remove and replace components of roofing system where inspections indicate that they do not  
15 comply with specified requirements.

- 16 E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or  
17 additional work complies with specified requirements.

18 3.9 PROTECTING AND CLEANING

- 19 A. Protect membrane roofing system from damage and wear during remainder of construction period. When  
20 remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage,  
21 describing its nature and extent in a written report, with copies to Architect and Owner.

- 22 B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements,  
23 repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and  
24 deterioration at time of Substantial Completion and according to warranty requirements.

- 25 C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures  
26 recommended by manufacturer of affected construction.

27 END OF SECTION 075323



1 SECTION 076200 - SHEET METAL FLASHING AND TRIM

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Manufactured reglets.
- 6 2. Formed roof-drainage sheet metal fabrications.
- 7 3. Formed low-slope roof sheet metal fabrications.
- 8 4. Formed wall sheet metal fabrications.

9 B. Related Requirements:

- 10 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
- 11 2. Section 075323 "EPDM Roofing" for installing sheet metal flashing and trim integral with
- 12 membrane roofing.
- 13 3. Section 077100 "Roof Specialties" for manufactured roof specialties not part of sheet metal
- 14 flashing and trim.

15 1.2 COORDINATION

- 16 A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be
- 17 flashed, and joints and seams in adjacent materials.

- 18 B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints,
- 19 and seams to provide leakproof, secure, and noncorrosive installation.

20 1.3 PREINSTALLATION MEETINGS

- 21 A. Preinstallation Conference: Conduct conference at Project site.

- 22 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment,
- 23 and facilities needed to make progress and avoid delays.
- 24 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and
- 25 condition of other construction that affect sheet metal flashing and trim.
- 26 3. Review requirements for insurance and certificates if applicable.
- 27 4. Review sheet metal flashing observation and repair procedures after flashing installation.

28 1.4 ACTION SUBMITTALS

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

- 30 1. Include construction details, material descriptions, dimensions of individual components and
- 31 profiles, and finishes for each manufactured product and accessory.

- 32 B. Shop Drawings: For sheet metal flashing and trim.

- 33 1. Include plans, elevations, sections, and attachment details.

2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of roof-penetration flashing.
8. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
9. Include details of special conditions.
10. Include details of connections to adjoining work.
11. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches (1:5).

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

#### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of sheet metal flashing and trim as part of punched opening mockup as specified in Section 084113 "Aluminum-Framed Entrances and Storefronts." Include supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

## 1.9 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

## 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

## 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, oversteering of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

## 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish: Two-coat fluoropolymer; AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Color: Match color of EIFS wall finish

2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Sheet Metals:

a. Exposed Coil-Coated Finish:

i. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- Color SMF-1: Matches Stading-Seam Metal Roof Panel
- Color SMF-2: Matches Storefront and Curtain Wall
- Color SMF-3: Matches IMWP-1
- Color SMF-4: Matches IMWP-2

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: 2D (dull, cold rolled).

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

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

- a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
- b. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Grace Ice and Water Shield HT.
- c. Henry Company; Blueskin PE200 HT.

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

- 1 B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and  
2 other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary  
3 sheet metal or manufactured item.
- 4 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
- 5 a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-  
6 applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of  
7 exposed fasteners bearing on weather side of metal.
- 8 b. Blind Fasteners: Stainless-steel rivets suitable for metal being fastened.
- 9 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- 10 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- 11 C. Solder for Stainless Steel: ASTM B 32, Grade Sn60 or Grade Sn96, with acid flux of type recommended  
12 by stainless-steel sheet manufacturer.
- 13 D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with  
14 release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm)  
15 wide and 1/8 inch (3 mm) thick.
- 16 E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use  
17 classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- 18 F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene  
19 plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- 20 G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- 21 H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 22 2.5 MANUFACTURED REGLETS

- 23 A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate  
24 reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -  
25 welded corners and junctions.
- 26 1. Material: Stainless steel, 0.019 inch (0.48 mm) thick.
- 27 2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or  
28 other suitable weatherproofing washers, and with channel for sealant at top edge.
- 29 3. Stucco Type: Provide with upturned fastening flange and extension leg of length to match  
30 thickness of applied finish materials.
- 31 4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special  
32 fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section  
33 ends.
- 34 5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
- 35 6. Accessories:
- 36 a. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing  
37 to prevent wind uplift of counterflashing's lower edge.
- 38 7. Finish: Mill.

## 2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  2. Obtain field measurements for accurate fit before shop fabrication.
  3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams for Metals Being Soldered: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Seams for Aluminum with Painted or Coated Finishes: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- I. Do not use graphite pencils to mark metal surfaces.

## 2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

## A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- (2400-mm-) long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

5. Gutters with Girth up 15 Inches: Fabricate from the following materials:
  - a. Aluminum: 0.032 inch thick.
  - b. Galvanized Steel: 0.022 inch thick.
6. Gutters with Girth 16 to 20 Inches: Fabricate from the following materials:
  - a. Aluminum: 0.040 inch thick.
  - b. Galvanized Steel: 0.028 inch thick.
7. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following materials:
  - a. Aluminum: 0.050 inch thick.
  - b. Galvanized Steel: 0.034 inch thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Hanger Style: Stand-off U-bracket.
2. Fabricate from the following materials:
  - a. Aluminum: 0.024 inch thick.
  - b. Galvanized Steel: 0.022 inch thick.

## 2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following material:
1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- B. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following material:
1. Aluminum: 0.032 inch (0.81 mm) thick.
- C. Roof-Penetration Flashing: Fabricate from the following material:
1. Stainless Steel: 0.019 inch (0.48 mm) thick.

## 2.9 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings; and form with 2-inch- (50-mm-) high, end dams. Fabricate from the following material:
1. Stainless Steel: 0.016 inch (0.40 mm) thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following material:
1. Aluminum, 0.032 inch (0.81 mm) thick; unless otherwise indicated.
  2. Stainless steel, 0.016 inch (0.40 mm) thick; for flashings in contact with concrete or masonry.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
  2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.
- B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

## 3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  5. Torch cutting of sheet metal flashing and trim is not permitted.
  6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.



- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
  2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder aluminum sheet.
  2. Do not use torches for soldering.
  3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
  4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

### 3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters:
1. Join sections with joints sealed with sealant.
  2. Provide for thermal expansion.
  3. Attach gutters at eave or fascia to firmly anchor them in position.
  4. Provide end closures and seal watertight with sealant.
  5. Slope to downspouts.
- C. Downspouts:
1. Join sections with 1-1/2-inch telescoping joints.
  2. Provide hangers with fasteners designed to hold downspouts securely to walls.
  3. Locate hangers at top and bottom and at approximately 60 inches o.c.

## 3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm). Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

## 3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

## 3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

## 3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

## SECTION 077100 - ROOF SPECIALTIES

## PART 1 - GENERAL

## 1.1 SUMMARY

A. Section Includes: Manufactured metal roof-edge specialties.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

## 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

## 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

C. Samples for Verification: Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.

1. Include roof-edge specialties made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

## 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For roof-edge flashings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, approximately 10 feet (3.0 m) long, including supporting construction, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

#### 1.8 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.9 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. FM Approvals' Listing: Manufacture and install roof-edge specialties that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
- C. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 ROOF-EDGE SPECIALTIES

- A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.
1. Basis-of-Design Product: Subject to compliance with requirements, provide OMG EdgeSystems (omgroofing.com); TerminEdge™ or comparable product by one of the following:
    - a. Hickman Company, W. P.
    - b. Metal-Era, Inc.
    - c. Metal-Fab Manufacturing, LLC.
    - d. Perimeter Systems; a division of Southern Aluminum Finishing Company, Inc.
  2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch (1.27 mm) thick.
    - a. Surface: Smooth, flat finish.
    - b. Finish: Two-coat fluoropolymer.
    - c. Color: As selected by Architect from manufacturer's full range.
  3. Corners: Factory mitered and continuously welded or mechanically clinched and sealed watertight.
  4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
  5. Receiver: Manufacturer's standard material and thickness.

## 2.3 MATERIALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

## 2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F (29 deg C).
3. Products: Subject to compliance with requirements, provide one of the following:
  - a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
  - b. Grace Construction Products, a unit of W. R. Grace & Co.; Grace Ice and Water Shield HT or Ultra.
  - c. Henry Company; Blueskin PE200 HT.

- B. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum.

## 2.5 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

- B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

- C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

- E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Aluminum Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
  1. Apply continuously under roof-edge specialties.
  2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.
- B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.3 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  2. Provide uniform, neat seams with minimum exposure of solder and sealant.

3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

- D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws; or to penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

### 3.4 ROOF-EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

### 3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

- B. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100



1 SECTION 077233 - ROOF HATCHES

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes: Roof hatches.

5 B. Related Requirements:

6 1. Section 055000 "Metal Fabrications" for metal ladders for access to roof hatches.

7 2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing and  
8 miscellaneous sheet metal trim and accessories.

9 1.2 COORDINATION

10 A. Coordinate layout and installation of roof hatches with roofing membrane and base flashing  
11 and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive  
12 installation.

13 1.3 ACTION SUBMITTALS

14 A. Product Data: For roof hatches. Include construction details, material descriptions, dimensions of  
15 individual components and profiles, and finishes.

16 B. Shop Drawings: For roof hatches. Include plans, elevations, keyed details, and attachments to other  
17 work. Indicate dimensions, loadings, and special conditions.

18 C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size  
19 to adequately show color.

20 1.4 INFORMATIONAL SUBMITTALS

21 A. Sample Warranties: For manufacturer's special warranties.

22 1.5 CLOSEOUT SUBMITTALS

23 A. Operation and Maintenance Data: For roof hatches to include in operation and maintenance manuals.

24 1.6 WARRANTY

25 A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to  
26 repair finishes or replace roof hatches that show evidence of deterioration of factory-applied finishes  
27 within specified warranty period.

28 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

29 a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

- 1                   b.     Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- 2                   c.     Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 3                   2.     Finish Warranty Period: 20 years from date of Substantial Completion.

## 4   PART 2 - PRODUCTS

### 5   2.1     PERFORMANCE REQUIREMENTS

- 6       A.     General Performance: Roof hatches shall withstand exposure to weather and resist thermally induced
- 7               movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture,
- 8               fabrication, installation, or other defects in construction.

### 9   2.2     ROOF HATCHES

- 10       A.     Roof Hatches: Metal roof-hatch units of thermally broken design with lids and insulated double-walled
- 11               curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing
- 12               and weathertight perimeter gasketing, integral metal cant or stepped integral metal cant raised the
- 13               thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

- 14           1.     Basis-of-Design Product: Subject to compliance with requirements, provide The Bilco Company,
- 15               New Haven CT (bilco.com); Type F-50TB or a comparable product by one of the following:

- 16               a.     Babcock-Davis
- 17               b.     Nystrom, Inc.

- 18       B.     Type and Size: Single-leaf lid, 48 inches by 48 inches clear inside of frame.

- 19       C.     Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift
- 20               load.

- 21       D.     Hatch Material: Aluminum sheet.

- 22           1.     Thickness: Manufacturer's standard thickness for hatch size indicated, but not less than 0.079 inch
- 23               (2.01 mm).
- 24           2.     Finish: Mill finish.

- 25       E.     Construction:

- 26           1.     Insulation: Polyisocyanurate board.
- 27           2.     Nailer: Factory-installed wood nailer continuous around hatch perimeter.
- 28           3.     Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of
- 29               same material and finish as outer metal lid.
- 30           4.     Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
- 31           5.     On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
- 32           6.     Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise
- 33               indicated.
- 34           7.     Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height
- 35               that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level, unless
- 36               otherwise indicated. Equip hatch with water diverter or cricket on side that obstructs water flow.

- 37       F.     Hardware: Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel
- 38               butt- or pintle-type hinge system, and padlock hasps inside and outside.

- G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
  2. Height: 42 inches (1060 mm) above finished roof deck.
  3. Material: Steel tube.
  4. Post: 1-5/8-inch- (41-mm-) diameter pipe.
  5. Finish: Manufacturer's standard baked enamel or powder coat.
- a. Color: As selected by Architect from manufacturer's full range.

### 2.3 ROOF HATCH SAFETY RAILING

- A. Basis-of-Design Manufacturer: Type Bil-Guard® 2.0 Roof Hatch Railing System; Model RL2-F by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 800-366-6530, Fax: 1-203-535-1582, Web: [www.bilco.com](http://www.bilco.com) or a comparable product by one of the following:
1. Babcock-Davis
  2. Nystrom, Inc.
- B. Finish: Manufacturer's standard baked enamel or powder coat.
- a. Color: RAL 1018, Safety Yellow.

### 2.4 METAL MATERIALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
1. Mill finish aluminum.
  2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- B. Steel Tube: ASTM A 500/A 500M, round tube.

### 2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C), thickness as indicated.
- C. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

- F. Underlayment: Self-adhering, high-temperature sheet; minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
- G. Fasteners: Roof hatch manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- I. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof hatch manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- J. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- K. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

## 2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof hatches.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install roof hatches according to manufacturer's written instructions.

1. Install roof hatches level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof hatches securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof hatches and fit them to substrates.
4. Install roof hatches to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing roof hatches directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof hatches for waterproof performance.

- C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach ladder-assist post according to manufacturer's written instructions.

- D. Seal joints with elastomeric or butyl sealant as required by roof hatch manufacturer.

### 3.3 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

- B. Clean off excess sealants.

- C. Replace roof hatches that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077233

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### SECTION 077253 - SNOW GUARDS

#### **TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.

#### **Content Requests:**

[<Double click here to submit questions, comments, or suggested edits to this Section.>](#)

#### **Access Manufacturer-Provided, AIA MasterSpec-Based Sections:**

[<Double click here for this Section based on specific manufacturer's products set as Basis-of-Design at ProductMasterSpec.com.>](#)

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Rail-type, seam-mounted snow guards.

## 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.

Retain subparagraph below for rail-type snow guards.

1. Include details of rail-type snow guards.

Retain "Samples" Paragraph below for single-stage Samples, with a subordinate list if applicable.

C. Samples:

1. Rail-Type Snow Guards: Bracket, 12-inch-long rail, and installation hardware.

a. For units with factory-applied finishes, submit manufacturer's standard color selections.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor.

## 1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit adhesive-mounted snow guards to be installed, and adhesive cured, according to adhesive manufacturer's written instructions.

## PART 2 - PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

## 2.1 PERFORMANCE REQUIREMENTS

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

Differential values in "Temperature Change" Subparagraph below (for aluminum in particular) are suitable for most of the United States.

1. Temperature Change: 120 deg , ambient; 180 deg F, material surfaces.

Retain "Structural Performance" Paragraph below if detailed design is assigned to manufacturer.

B. Structural Performance: Snow guards shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Snow Loads: As indicated on Drawings.

## 2.2 RAIL-TYPE SNOW GUARDS

### A. Rail-Type, Seam-Mounted Snow Guards:

1. Rail-Type, Seam-Mounted Snow Guards: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with one rail with color-matching inserts of material and finish used for metal roofing.
  - a. Basis of Design Product: Alpine SnowGuards, Div. of Vermont Slate & Copper Services, Inc.; S-5! ColorGard.
  - b. Color:
    - 1) Color MRP-1: Color match Metal Roof Panel MRP-1.
2. Seam clamps: ASTM B221 aluminum extrusion or ASTM B85/B85M aluminum casting with stainless steel set screws incorporating round nonpenetrating point; designed for use with applicable roofing system to which clamp is attached.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
  1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

Retain this article for adhesively attached snow guards.

- A. Clean and prepare substrates for bonding snow guards.
- B. Prime substrates according to snow guard manufacturer's written instructions.

### 3.3 INSTALLATION

- A. Install snow guards according to manufacturer's written instructions.

Retain one of two subparagraphs below as applicable to Project.

1. Space rows as indicated on Drawings.
2. Space rows as recommended by manufacturer.

Retain paragraph(s) below for roofing and snow guard types used for Project.

- B. Attachment for Standing-Seam Metal Roofing:



- 1 1. Do not use fasteners that will penetrate metal roofing or fastening methods that void metal roofing  
2 finish warranty.
- 3 [Retain first subparagraph below for copper roof material.](#)
- 4 a. Solder to copper roofing according to manufacturer's instructions.
- 5 2. Rail-Type, Seam-Mounted Snow Guards:
- 6 a. Install brackets to vertical ribs in straight rows.
- 7 b. Secure with stainless steel set screws, incorporating round nonpenetrating point, on same  
8 side of standing seam.
- 9 c. Torque set screw according to manufacturer's instructions.
- 10 d. Install cross members to brackets.
- 11 END OF SECTION 077253

1 SECTION 078413 - PENETRATION FIRESTOPPING

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Penetrations in fire-resistance-rated walls.  
6 2. Penetrations in horizontal assemblies.

7 B. Related Requirements:

- 8 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction.

9 1.2 PREINSTALLATION MEETINGS

- 10 A. Preinstallation Conference: Conduct conference at Project site.

11 1.3 ACTION SUBMITTALS

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

- 13 B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping  
14 system, and design designation of qualified testing and inspecting agency.

- 15 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and  
16 inspecting agency's illustration for a particular penetration firestopping system, submit illustration,  
17 with modifications marked, approved by penetration firestopping system manufacturer's fire-  
18 protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.  
19 Obtain approval of authorities having jurisdiction prior to submittal.

20 1.4 INFORMATIONAL SUBMITTALS

- 21 A. Qualification Data: For Installer.

- 22 B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing  
23 agency.

24 1.5 CLOSEOUT SUBMITTALS

- 25 A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed  
26 in compliance with requirements and manufacturer's written instructions.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## 1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

## A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
  - a. Penetration firestopping systems shall bear classification marking of UL in its "Fire Resistance Directory."

## 2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Select and provide systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated, for each penetration condition in fire-resistance rated construction assemblies. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
  2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

### 2.3 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

## 2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
  2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

## 3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
  2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

#### 3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

#### 3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

#### 3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

1 SECTION 078443 - JOINT FIRESTOPPING

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes: Joints in or between fire-resistance-rated constructions.

5 B. Related Requirements:

- 6 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls,  
7 horizontal assemblies, and smoke barriers and for wall identification.  
8 2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition  
9 heads.

10 1.2 PREINSTALLATION MEETINGS

11 A. Preinstallation Conference: Conduct conference at Project site.

12 1.3 ACTION SUBMITTALS

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

14 B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping  
15 system, and design designation of qualified testing agency.

- 16 1. Engineering Judgments: Where Project conditions require modification to a qualified testing  
17 agency's illustration for a particular joint firestopping system condition, submit illustration, with  
18 modifications marked, approved by joint firestopping system manufacturer's fire-protection  
19 engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

20 1.4 INFORMATIONAL SUBMITTALS

21 A. Qualification Data: For Installer.

22 B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing  
23 agency.

24 1.5 CLOSEOUT SUBMITTALS

25 A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in  
26 compliance with requirements and manufacturer's written instructions.

27 1.6 PROJECT CONDITIONS

28 A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate  
29 temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates  
30 are wet due to rain, frost, condensation, or other causes.

- 1 B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of  
2 ventilation or, where this is inadequate, forced-air circulation.

3 1.7 COORDINATION

- 4 A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to  
5 specified firestopping system design.

- 6 B. Coordinate sizing of joints to accommodate joint firestopping systems.

7 PART 2 - PRODUCTS

8 2.1 PERFORMANCE REQUIREMENTS

- 9 A. Fire-Test-Response Characteristics:

- 10 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities  
11 having jurisdiction.  
12 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated  
13 systems complying with the following requirements:  
14 a. Joint firestopping systems shall bear classification marking of UL in its "Fire Resistance  
15 Directory."

16 2.2 JOINT FIRESTOPPING SYSTEMS

- 17 A. Joint Firestopping Systems: Select and provide systems that resist spread of fire, passage of smoke and  
18 other gases, and maintain original fire-resistance rating of assemblies in or between which joint  
19 firestopping systems are installed, for each condition in fire-resistance rated construction assemblies.  
20 Joint firestopping systems shall accommodate building movements without impairing their ability to  
21 resist the passage of fire and hot gases.

- 22 B. Joints In or Between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings  
23 determined per ASTM E 1966 or UL 2079.

- 24 1. Manufacturers: Subject to compliance with requirements, provide products by one of the  
25 following:  
26 a. 3M Fire Protection Products.  
27 b. A/D Fire Protection Systems Inc.  
28 c. BlazeFrame Industries.  
29 d. Grabber Construction Products.  
30 e. Hilti, Inc.  
31 f. Metal-Lite.  
32 g. Nelson Firestop; a brand of Emerson Industrial Automation.  
33 h. NUCO Inc.  
34 i. Passive Fire Protection Partners.  
35 j. RectorSeal.  
36 k. Roxul Inc.  
37 l. Specified Technologies, Inc.  
38 m. Thermafiber, Inc.; an Owens Corning company.  
39 n. Tremco, Inc.



2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

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

#### 3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

#### 3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

#### 3.4 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

#### 3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

#### 3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078443

1 SECTION 079200 - JOINT SEALANTS

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Silicone joint sealants.
- 6 2. Nonstaining silicone joint sealants.
- 7 3. Urethane joint sealants.
- 8 4. Mildew-resistant joint sealants.
- 9 5. Butyl joint sealants.
- 10 6. Latex joint sealants.
- 11 7. Acoustical joint sealants.
- 12 8. Preformed foam joint seals for exterior wall expansion joints.

13 1.2 PREINSTALLATION MEETINGS

- 14 A. Preinstallation Conference: Conduct conference at Project site.

15 1.3 ACTION SUBMITTALS

- 16 A. Product Data: For each joint-sealant product.

- 17 B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing  
18 the full range of colors available for each product exposed to view.

- 19 C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint  
20 sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material  
21 matching the appearance of exposed surfaces adjacent to joint sealants.

- 22 D. Joint-Sealant Schedule: Prepare a diagram or plan to indicate joint-sealant locations; marked-up copy of  
23 Contract Documents may be used. Include the following information:

- 24 1. Joint-sealant application, joint location, and designation.
- 25 2. Joint-sealant manufacturer and product name.
- 26 3. Joint-sealant formulation.
- 27 4. Joint-sealant color.

28 1.4 INFORMATIONAL SUBMITTALS

- 29 A. Qualification Data: For qualified testing agency.

- 30 B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency, or  
31 by manufacturer and witnessed by a qualified testing agency.

- 32 C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and  
33 substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

F. Field-Adhesion-Test Reports: For each sealant application tested.

G. Sample Warranties: For special warranties.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

## 1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with stone and masonry substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
  - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
    - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
4. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

B. Special Manufacturer's Warranty for Joint Sealants: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Special Manufacturer's Warranty for Preformed Foam Joint Seals: Manufacturer agrees to furnish preformed joint seals to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

D. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Acoustical Joint Sealants: Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

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

- a. GE Construction Sealants; SCS2700 SilPruf LM.
- b. Sika Corporation U.S.; Sikasil WS-290 or Sikasil WS-290 FPS.

B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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

- a. Dow Corning Corporation; 791.
- b. GE Construction Sealants; SCS2000 SilPruf.
- c. Pecora Corporation; PCS.
- d. Sika Corporation U.S.; Sikasil WS-295 or Sikasil WS-295 FPS.

### 2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

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

- a. Pecora Corporation; 890FTS/TXTR or 890 NST.
- b. Tremco Incorporated; Spectrem 1.

C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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

- a. Dow Corning Corporation; 795.
- b. GE Construction Sealants; SilPruf NB.
- c. Tremco Incorporated; Spectrem 2 or Spectrem 3.

#### 2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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

- a. BASF Construction Chemicals, LLC, Building Systems; Sonalastic TX1.
- b. Pecora Corporation; Dynatrol I-XL.
- c. Sherwin-Williams Company (The); Stampede-1 or Stampede-TX.
- d. Sika Corporation U.S.; Sikaflex Textured Sealant.
- e. Tremco Incorporated; Dymonic.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.

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

- a. BASF Construction Chemicals, LLC, Building Systems; Sonolastic SL 1.
- b. Pecora Corporation; NR-201.
- c. Sherwin-Williams Company (The); Stampede 1SL.

C. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Pecora Corporation; Dynatrol II.

D. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T and NT.

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

- a. Bostik, Inc.; Chem-Calk 505.
- b. Sika Corporation U.S.; Sikaflex - 2c NS EZ Mix.

- E. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.

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

- a. Bostik, Inc.; Chem-Calk 555-SL.
- b. Pecora Corporation; Dynatrol II SG or Urexpan NR 200
- c. Sherwin-Williams Company (The); Stampede-2SL.
- d. Tremco Incorporated; THC 900/901.

## 2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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

- a. Dow Corning Corporation; 786-M White.
- b. GE Construction Sealants; SCS1700 Sanitary.
- c. Tremco Incorporated; Tremsil 200.

## 2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

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

- a. Bostik, Inc.; Chem-Calk 300.
- b. Pecora Corporation; BC-158.

## 2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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

- a. BASF Construction Chemicals, LLC, Building Systems; Sonolac.
- b. Pecora Corporation; AC-20.
- c. Sherwin-Williams Company (The); 850A, 950A, or PowerHouse.
- d. Tremco Incorporated; Tremflex 834.

## 2.8 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.

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



- a. GE Construction Sealants; RCS20 Acoustical.
- b. Pecora Corporation; AC-20 FTR or AIS-919.
- c. Serious Energy Inc.; Quiet Seal Pro.
- d. Tremco, Incorporated; Tremco Acoustical Sealant.
- e. USG Corporation; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

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

- a. Pecora Corporation; BA-98.
- b. Serious Energy Inc.; Quiet Seal 350.

## 2.9 PREFORMED FOAM JOINT SEALS

A. Preformed Silicone-Faced Foam Seal: Manufacturer's standard preformed, precompressed, binary seal combining factory-applied low-modulus silicone facing with expanding foam sealant backing, containing no wax or wax compounds; factory produced in precompressed sizes and in roll form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following:

1. Basis-of-Design Product: EMSEAL Joint Systems, Ltd.; Seismic Colorseal.
2. Movement Capability: Plus 50 percent and minus 50 percent, 100 percent total movement.
3. Joint Seal Color: As selected by Architect from full range of industry colors.

## 2.10 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

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

- a. BASF Construction Chemicals, LLC, Building Systems.
- b. Construction Foam Products, a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type B (bicellular material with a surface skin), or either of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.11 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

#### 3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

- a. Concrete.
- b. Masonry.
- c. Unglazed surfaces of ceramic tile.
- d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

- a. Metal.
- b. Glass.
- c. Porcelain enamel.
- d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- G. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
- H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

### 3.4 INSTALLATION OF PREFORMED JOINT SEALS

- A. Installation of Preformed Foam Joint Seals:

1. Install each length of seal immediately after removing protective wrapping.
2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

### 3.5 FIELD QUALITY CONTROL

#### A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
  - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
  - b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
  - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
  - a. Whether sealants filled joint cavities and are free of voids.
  - b. Whether sealant dimensions and configurations comply with specified requirements.
  - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

#### B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.6 CLEANING

#### A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

## 3.7 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

## 3.8 JOINT-SEALANT SCHEDULE

- A. General: Provide joint sealants for each application as scheduled in this Article or as indicated on Drawings to comply with requirements in this Section.

- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

## 1. Joint Locations:

- a. Isolation and contraction joints in cast-in-place concrete slabs.
- b. Joints between different materials.
- c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 25, T, NT; or urethane, S, P, 25, T, NT.

- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

## 1. Joint Locations:

- a. Construction joints in cast-in-place concrete.
- b. Joints in masonry wall systems.
- c. Joints in exterior insulation and finish systems.
- d. Joints between metal panels.
- e. Joints between different materials listed above.
- f. Perimeter joints between materials listed above and frames of doors, windows and other glazing systems and louvers.
- g. Control and expansion joints in ceilings and other overhead surfaces.
- h. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50 or 50, NT.

- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

## 1. Joint Locations:

- a. Isolation joints in cast-in-place concrete slabs.
- b. Control and expansion joints in tile flooring.
- c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT; or Urethane, M, NS, 25, T, NT.

- E. Joint-Sealant Application: Interior perimeter joints between wall materials and frames of windows and other exterior glazing systems.

1. Joint Sealant: Silicone S, NS, 100/50 or 50, NT.

- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

## 1. Joint Locations:

- a. Control and expansion joints on exposed interior surfaces of exterior walls.
- b. Tile control and expansion joints.
- c. Vertical joints on exposed surfaces of unit masonry and concrete walls and partitions.
- d. Other joints as indicated on Drawings.

## 2. Joint Sealant: Urethane, S, NS, 25, NT; or Urethane, S, NS, 50, NT.

## G. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

## 1. Joint Locations:

- a. Control joints on exposed interior surfaces of exterior walls.
- b. Perimeter joints between interior wall surfaces and frames of interior doors and glazed openings.
- c. Other joints as indicated on Drawings.

## 2. Joint Sealant: Acrylic latex.

## H. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

## 1. Joint Locations:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
- b. Tile control and expansion joints where indicated.
- c. Other joints as indicated on Drawings.

## 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.

## I. Joint-Sealant Application: Concealed mastics.

## 1. Joint Locations:

- a. Aluminum thresholds.
- b. Sill plates.
- c. Other joints as indicated on Drawings.

## 2. Joint Sealant: Butyl-rubber based.

## J. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

## 1. Joint Location:

- a. Acoustical joints where indicated.
- b. Other joints as indicated.

## 2. Joint Sealant: Acoustical sealant.

END OF SECTION 079200

1 SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section includes:

- 5 1. Interior steel doors and frames.
- 6 2. Exterior steel doors and frames.

7 B. Related Requirements:

- 8 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

9 1.2 ALTERNATES

- 10 A. Refer to Section 01300 "Alternates" for effect on work of this Section.

11 1.3 DEFINITIONS

- 12 A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-  
13 HMMA 803 or SDI A250.8.

14 1.4 COORDINATION

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

- 18 B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control  
19 and security systems.

20 1.5 ACTION SUBMITTALS

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

- 22 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and  
23 finishes.

- 24 B. Shop Drawings: Include the following:

- 25 1. Elevations of each door type.
- 26 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
- 27 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
- 28 4. Locations of reinforcement and preparations for hardware.
- 29 5. Details of each different wall opening condition.
- 30 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and  
31 security systems.

- 1 7. Details of anchorages, joints, field splices, and connections.
- 2 8. Details of accessories.
- 3 9. Details of moldings, removable stops, and glazing.

- 4 C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier,
- 5 using same reference numbers for details and openings as those on Drawings. Coordinate with final door
- 6 hardware schedule.

#### 7 1.6 INFORMATIONAL SUBMITTALS

- 8 A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a
- 9 qualified testing agency.

#### 10 1.7 DELIVERY, STORAGE, AND HANDLING

- 11 A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit
- 12 and Project-site storage. Do not use nonvented plastic.

- 13 1. Provide additional protection to prevent damage to factory-finished units.

- 14 B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs
- 15 and mullions.

- 16 C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on
- 17 minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between
- 18 each stacked door to permit air circulation.

### 19 PART 2 - PRODUCTS

#### 20 2.1 MANUFACTURERS

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

- 22 1. Ceco Door; ASSA ABLOY.
- 23 2. Curries Company; ASSA ABLOY.
- 24 3. Deansteel Manufacturing Company, Inc.
- 25 4. Fleming Door Products Ltd.; Assa Abloy Group Company.
- 26 5. Karpen Steel Custom Doors & Frames.
- 27 6. Mesker Door Inc.
- 28 7. Pioneer Industries.
- 29 8. Republic Doors and Frames.
- 30 9. Security Metal Products; a brand of ASSA ABLOY.
- 31 10. Steelcraft; an Allegion brand.

#### 32 2.2 PERFORMANCE REQUIREMENTS

- 33 A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency
- 34 acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at
- 35 positive pressure according to NFPA 252 or UL 10C.



1. Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

- B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. (2.27 W/K x sq. m) when tested according to ASTM C 518.

## 2.3 INTERIOR STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A.

### 1. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches (44.5 mm).
- c. Face: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm), unless otherwise indicated.

- 1) Provide doors made with metallic-coated steel sheet at locations indicated.

- d. Edge Construction: Model 2, Seamless.
- a. Core: Manufacturer's standard, unless otherwise indicated.
- b. Fire-Rated Core: Manufacturer's standard vertical steel stiffener or laminated mineral board core for fire-rated doors.

### 2. Frames:

- a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).

- 1) Provide frames made with metallic-coated steel sheet at locations indicated.

- b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
- c. Construction: Full profile welded.

### 3. Exposed Finish: Prime.

## 2.4 EXTERIOR STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A.

### 1. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches (44.5 mm).
- c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
- d. Edge Construction: Model 2, Seamless.

- e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
  - f. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
  - g. Core: Manufacturer's polystyrene or polyurethane insulation.
2. Frames:
- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
  - b. Construction: Full profile welded; thermally broken.
- 1) Thermal Break: Fabricate exterior frames with an integral, concealed, low-conductance thermal barrier that eliminates direct metal-to-metal contact.
3. Exposed Finish: Prime.

## 2.5 BORROWED LITES

- A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
- B. Construction: Full profile welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

## 2.6 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
  - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

## 2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

## 2.8 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
  - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
  - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
  - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

## 2.9 STEEL FINISHES

## A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

## 3.2 INSTALLATION

- A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

- B. Hollow-Metal Frames: Comply with SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

- a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.

- b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.

3. Floor Anchors: Secure with postinstalled expansion anchors.

- a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames unless otherwise indicated.

5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

- a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

- b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

- c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

- d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

1 C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified  
2 below.

3 1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.

4 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

5 3. Smoke-Control Doors: Install doors according to NFPA 105.

6 D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal  
7 manufacturer's written instructions.

8 3.3 CLEANING AND TOUCHUP

9 A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat  
10 and apply touchup of compatible air-drying, rust-inhibitive primer.

11 B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint  
12 according to manufacturer's written instructions.

13 END OF SECTION 081113

## 1 SECTION 081416 - FLUSH WOOD DOORS

## 2 PART 1 - GENERAL

## 3 1.1 SUMMARY

## 4 A. Section Includes:

- 5 1. Solid-core doors with wood-veneer faces.
- 6 2. Factory finishing flush wood doors.
- 7 3. Factory fitting flush wood doors to frames and factory machining for hardware.

## 8 B. Related Requirements:

- 9 1. Section 088000 "Glazing" for glass view panels in flush wood doors.

## 10 1.2 ACTION SUBMITTALS

11 A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.  
12 Include factory-finishing specifications.

13 B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door;  
14 construction details not covered in Product Data; and the following:

- 15 1. Dimensions and locations of blocking.
- 16 2. Dimensions and locations of mortises and holes for hardware.
- 17 3. Dimensions and locations of cutouts.
- 18 4. Undercuts.
- 19 5. Requirements for veneer matching.
- 20 6. Factory finish requirements.
- 21 7. Fire-protection ratings for fire-rated doors.

22 C. Samples for Initial Selection: For factory-finished doors.

23 D. Samples for Verification:

- 24 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250  
25 mm), for each material and finish. For each wood species and transparent finish, provide set of  
26 three Samples showing typical range of color and grain to be expected in finished Work.

## 27 1.3 INFORMATIONAL SUBMITTALS

28 A. Sample Warranty: For special warranty.

29 B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

## 30 1.4 QUALITY ASSURANCE

31 A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality  
32 Certification Program.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eggers Industries.
  - 2. Graham Wood Doors; an Assa Abloy Group company.
  - 3. Marshfield-Algoma™.
  - 4. Mohawk Doors; a Masonite company.
  - 5. VT Industries, Inc.

- B. Source Limitations: Obtain flush wood doors from single manufacturer.

## 2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI "Architectural Woodwork Standards."
  - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
  2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Particleboard-Core Doors:
  1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde.
  2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware and as follows:
    - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
    - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have kick, mop, or armor plates.
  3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- F. Structural-Composite-Lumber-Core Doors:
  1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf (3100 N).
    - b. Screw Withdrawal, Edge: 400 lbf (1780 N).
- G. Mineral-Core Doors:
  1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
  2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware and as follows:
    - a. 5-inch (125-mm) top-rail blocking.
    - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
    - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
    - d. 4-1/2-by-10-inch (114-by-250-mm) lock blocks or 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
  3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.



- a. Screw-Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Performance Grade: Performance Grade:

- a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated.  
b. ANSI/WDMA I.S. 1A Extra Heavy Duty: Toilet rooms, Housekeeping rooms; and Commissioners' Meeting Room.

2. Grade: Premium, with Grade A faces.

3. Species: Select White Birch.

4. Cut: Plain sliced (flat sliced).

5. Match between Veneer Leaves: Book match.

6. Assembly of Veneer Leaves on Door Faces: Center-balance.

7. Pair and Set Match: Provide for doors hung in same opening.

8. Exposed Vertical Edges: Same species as faces.

- a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edge.

- b. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf.

9. Core: Particleboard.

10. Construction: Five plies. hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.

2. Profile: Flush rectangular beads.

3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

## 2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Premium.

2. Finish: AWI "Architectural Woodwork Standards" System 5, conversion varnish; System 9, UV curable, acrylated epoxy, polyester, or urethane; System 10, UV curable, water based; or System 11, catalyzed polyurethane.

3. Staining: As selected by Architect from manufacturer's full range.

4. Effect: Filled finish.

5. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

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

### 3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.

2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

- 1    3.3        ADJUSTING
- 2        A.        Operation: Rehang or replace doors that do not swing or operate freely.
- 3        B.        Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be
- 4                repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.
- 5    END OF SECTION 081416

1 SECTION 083113 - ACCESS DOORS AND FRAMES

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

7 A. Section Includes:

- 8 1. Access doors and frames.  
9 2. Fire-rated access doors and frames.

10 B. Related Requirements:

- 11 1. Section 077200 "Roof Accessories" for roof hatches.  
12 2. Section 083113.53 "Security Access Doors and Frames" for access doors and frames for  
13 security applications.  
14 3. Section 083483 "Floor Doors" for doors installed in floors.  
15 4. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access  
16 doors.

17 1.3 ACTION SUBMITTALS

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

- 19 1. Include construction details, fire ratings, material descriptions, dimensions of individual  
20 components and profiles, and finishes.

21 B. Product Schedule: For access doors and frames.

22 1.4 CLOSEOUT SUBMITTALS

- 23 A. Record Documents: For fire-rated doors, list of applicable room name and number in which  
24 access door is located.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection[ **and temperature-rise limit**] ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Acudor Products Inc. UF-5000 or comparable product by one of the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Milcor
  - b. Cendrex, Inc.
3. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
4. Locations: Wall and ceiling.
5. Door Size: 12 inches by 12 inches.
6. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gauge, factory primed.
7. Frame Material: Same material and thickness as door.
8. Latch and Lock: Cam latch, screwdriver operated.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

## 2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

### 3.3 FIELD QUALITY CONTROL

- A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

### 3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

## SECTION 083463 - DETENTION HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes the following:
1. Detention swinging hollow metal doors.
  2. Detention hollow metal frames.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Detention doors and frames for this Contract shall be constructed as specified and to meet the following tests. An independent testing laboratory shall perform the tests described below, with data attesting to construction of the door and frame. Test data shall have been performed within the past five (5) years and shall be submitted with the shop drawing submittal.
1. Doors tested in accordance with Standard UL-752, "Bullet Penetration".
  2. Doors tested in accordance with ASTM F 1450, "Door Assembly Impact Test".
  3. Doors tested in accordance with ASTM F 1450, "Door Static Load Test".
  4. Doors tested in accordance with ASTM F 1450, "Door Rack Test".
  5. Doors tested in accordance with Methods E152, Standard UL-10 (B), or Methods NFPA 252, "Door Assembly Fire Test".
  6. Doors tested in accordance with ASTM F 1450, "Door Edge Crush Test".
  7. Doors tested in accordance with NAAMM HMMA 863-98, "Removable Glazing Stop Test".
  8. Frames tested in accordance with ASTM F1592, "Standard Test Methods for Detention Hollow Metal Vision Systems"

## 1.4 SUBMITTALS

- A. Product Data: Include manufacturer's data for fabrication and installation instructions.
- B. Shop Drawings:
1. Shop drawing submittals for Detention Hollow Metal Doors and Frames shall be submitted as an entire Section.
  2. Submit shop drawings for the fabrication and installation of detention hollow metal doors and frames. Hollow metal shop drawings shall use the same door and elevation numbers as indicated on the Contract Documents.
  3. Include details of each frame type, elevations of door design types, conditions at openings, reinforcement, factory fabricated accessories, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections.
  4. Show anchorage and accessory items.
- C. Samples:
1. Door: 1'-0" x 1'-0" corner section with hinge mortise and reinforcement showing internal construction.

2. Frame: 1'-0" x 1'-0" corner section showing welding of head to jamb. Include hinge mortise, reinforcement and plaster guard in one rabbet, and glazing stop applied as specified in the opposite rabbet. Glazing stop shall be applied in both head and jamb section to show corner joint.

3. Samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the manufacturer. No work represented by the samples shall be fabricated until the samples are approved, and any downgrading of quality demonstrated by the sample can be cause for refection of the work.

D. Certification by Manufacturer: That products supplied complies with performance requirements specified.

E. Product Test Reports: Showing compliance with specified requirements.

F. Warranties: Special warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

A. Provide detention hollow metal work manufactured by a single firm specializing in the production of this type of work.

B. Installation shall be under supervision of manufacturer-approved personnel.

C. When a fire resistance classification is shown or scheduled for steel doors and frames, provide fire rated doors investigated and tested as a fire door assembly, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors.

D. When a fire resistance classification is shown or scheduled for steel doors and/or frames containing components that have not been tested as an assembly, the manufacturer shall construct the door and frame components of the assembly in accord with the requirements of the testing laboratory for the desired fire resistance rating, and certify in writing to the Owner, Enforcing Authority, Contractor and the Architect that the door and frame components have been constructed in accord with the testing laboratory requirements in lieu of label.

#### 1.6 REFERENCES

A. American Society of Testing and Materials (ASTM)

B. National Association of Architectural Metal Manufacturers (NAAMM)

C. Hollow Metal Manufacturers Association (HMMA)

D. Underwriters Laboratories (UL)

#### 1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle hollow metal work per manufacturer's requirements.

#### 1.8 WARRANTY



- 1 A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other  
2 rights the Owner may have under other provisions of the Contract Documents and shall be in addition to,  
3 and run concurrent with, other warranties made by the Contractor under requirements of the Contract  
4 Documents.
- 5 B. Special Warranty: Submit a written warranty executed by the manufacturer and installer agreeing to repair  
6 or replace materials furnished under this Section that fail in materials or workmanship within the specified  
7 warranty period. Submit the warranty to the Architect for approval.
- 8 C. Warranty Period: One (1) year from date of Substantial Completion.

9 PART 2 - PRODUCTS

10 2.1 MANUFACTURER OF DETENTION HOLLOW METAL DOORS AND FRAMES

- 11 A. Acceptable Manufacturers:
- 12 1. Chief Industries; Grand Island, NE
  - 13 2. Corr-Fac. Corp.; Alpena, Michigan
  - 14 3. Habersham Metal Product Co.; Cornelia, Georgia
  - 15 4. Steel Door Industries, Inc.; Hartselle, AL
  - 16 5. Sweeper Metal Fabricators Corp.; Drumright, OK
  - 17 6. Trussbilt Inc.; St. Paul, MN
  - 18 7. Willo Products; Decatur, AL

19 2.2 DETENTION HOLLOW METAL DOORS

- 20 A. Materials:
- 21 1. Galvanealed steel sheets: Zinc-coated carbon steel sheets of commercial quality, complying with  
22 ASTM A526/A526, A60 zinc coating.
  - 23 2. Steel shall be free of scale, pitting, coil breaks or other surface blemishes. It shall be free of  
24 buckles, waves or any other defects caused by the use of improperly leveled sheets.
  - 25 3. Interior and exterior doors: Face sheets shall be 12 gauge galvanealed steel.
- 26 B. Construction:
- 27 1. Provide detention hollow metal doors of the types and sizes indicated on the drawings and  
28 schedules. Doors shall be constructed in accordance with the specifications and shall meet the  
29 performance requirements.
  - 30 2. Doors shall be neat in appearance and free from warpage or buckle. Edge bends shall be true and  
31 straight and of minimum radius for the thickness of material used.
  - 32 3. Internal Core Construction: One of the following two (2) types may be used:
    - 33 a. Steel stiffened by continuous vertically formed steel hat sections which, upon assembly, shall  
34 span the full thickness, full height and full width of the interior space between door faces.  
35 These stiffeners shall be of 16 gauge minimum to meet the performance standards  
36 established in the quality control section of this specification, spaced such that the vertical  
37 interior webs shall be no more than 4" o.c. and securely fastened to both face sheets by spot  
38 welds spaced a maximum of 3" o.c. vertically. Hat sections shall be welded together, both  
39 sides, by welds spaced a maximum of 6" vertically. Spaces between stiffeners shall be filled  
40 with 6.0 lbs./cu. ft. fiberglass or mineral rockwool batt-type material.

- b. Continuous, inner-reinforcement full height and width shall be true truss design with triangular form, 28 gauge minimum, the shape of which cannot be altered without changing the length of the sides. Flat apexes shall be resistance spot welded on 2 3/4" centers horizontally and 3" centers vertically. Each flute of reinforcement to be fire and sound insulated with six (6) pound density Rock Wool.
4. The vertical edges shall be reinforced by a continuous steel channel, not less than 10 gauge thickness extending the full length of the door. The top and bottom edges shall be closed with a continuous steel channel, not less than 10 gauge thickness, spot welded to both face sheets a maximum of 4" o.c. The 10 gauge closing end channel shall be continuously welded to the vertical reinforcing channel at all four corners producing a fully welded perimeter reinforcing channel.
5. Metal doors shall have a flush top and bottom edge channel of not less than 16 gauge and shall be welded to the closing channel at the corners and 1 2" long welds 12" on center.
6. Door face sheets shall be joined at their vertical edges by a continuous weld extending the full height of the door and finished smooth such that there are no visible seams.
7. Doors shall be smooth, flush surfaces without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts.
8. Edge profiles shall be provided on both vertical edges of doors as follows:
  - a. Single acting doors - beveled 1/8 in. in 2 in profile.
9. Hardware reinforcements and preparation:
  - a. Doors shall be mortised, reinforced, drilled and tapped at the factory for hardware, in accordance with the final approved hardware schedule and templates provided by the hardware supplier.
  - b. Minimum hardware reinforcement shall be as follows:
    - 1) Mortise hinges: Steel plate 3/16" thick x full height, secured by spot-welds 4" o.c.
    - 2) Mortise Locksets and Dead Bolts: 3/16" thick steel sheet, welded to inside of door on detention side (cell side) and 3/16" thick steel lock mounting plate, beveled at edges, applied to the surface of the door with security screws.
    - 3) Closers: 12 gauge steel sheet, secured with not less than 6 spot welds.
    - 4) Push Plates and Loop Pulls: 16 gauge steel sheet, secured with not less than 2 spot-welds.
    - 5) Automatic Door Bottoms: Reinforce for mortise-type units with 12 gauge steel, and 16 gauge for surface-applied units.
10. Removable lock cover plate to be on the hinge side, unless door swings into a room and there is no other access to the room, then removable lock cover plate is to be on the stop side.
11. Coordinate electric hardware requirements to be integrally built into the door with the hardware requirements.
12. Provide dust box (welded to interior of door edge) at bolt receiver hole.
13. Provide weep hole openings in the bottom of doors to permit the escape of entrapped moisture.

### 2.3 DETENTION HOLLOW METAL FRAMES

#### A. Materials:

1. Galvanealed steel sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A526/A526, A60 zinc coating.
2. Steel shall be free of scale, pitting, coil breaks or other surface blemishes. It shall be free of buckles, waves or any other defects caused by the use of improperly leveled sheets.
3. Interior and exterior openings: Steel shall be 12 gauge galvanealed steel.

#### B. Construction:

1. Provide detention hollow metal frames of the types and sizes indicated on the drawings and schedules. Frames shall be constructed in accordance with the specifications and shall meet the performance requirements.
2. Frames shall be neat in appearance, square, and free of defects, warpage and buckles. Press steel members shall be straight and of uniform profile throughout their lengths.
3. Jamb, header, and sill profiles shall be as indicated on the drawings.

4. Fabricate frames with mitered corners continuously welded through head inside corner and miter ground smooth.
5. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designated for splicing in the field by others. Where splicing is necessary, angle splices shall be installed at the corners of the profile, and shall extend at least 4 in. on either side of the joint. Splicing angles shall be the same gage thickness as the frame. Field splices shall be made in accordance with approved submittal drawings.
6. Frames for multiple openings shall have mullion members which, after fabrication, are closed tubular shapes conforming to profiles shown on the drawings, and having no visible seams or joints. All joints between faces of abutted members shall be continuously welded and finished smooth. All joints between stops of abutted members shall be welded along the soffit and shall be left neat and uniform in appearance. The General Contractor shall provide for welding and finishing all field joints between faces of abutted members.
7. Hardware reinforcements and preparation:
  - a. Frames shall be mortised, reinforced, drilled and tapped at the factory for hardware, in accordance with the final approved hardware schedule and templates provided by the hardware supplier.
  - b. Minimum hardware reinforcement shall be as follows:
    - 1) Hinges and Pivots: Steel plate 3/16" thick x full width of jamb x full height of jamb.
    - 2) Provide an additional 3/16" thick angle back up drilled and tapped to accommodate security screws, welded to reinforcing and inside trim of frame.
    - 3) Strike Plate Clips: Steel plate 3/16" thick x 1 1/2" wide x 3" long.
    - 4) Closers: 12 gauge steel sheet, secured with not less than 6 spot welds.
8. Floor anchors:
  - a. Floor anchors with two holes for fasteners shall be fastened inside jambs with at least four (4) spot welds per anchor.
  - b. Where so scheduled, adjustable floor anchors, providing not less than 2 in. height adjustment, shall be fastened inside jambs with at least four (4) spot welds per anchor.
  - c. Thickness of floor anchors shall be the same as frame.
9. Jamb anchors:
  - a. Anchor spacing:
    - 1) The number of jamb anchors provided on each jamb shall be as follows:
      - a) For borrowed lite frames provide two (2) anchors plus one (1) for each 18" or fraction thereof over 3'-0", spaced at 18" maximum between anchors.
      - b) For door frames provide two (2) anchors plus one (1) for each 18" or fraction thereof over 4'-6", spaced at 18" maximum between anchors (U.L. fire ratings may require additional anchors).
  - b. Masonry types:
    - 1) Frames for installation in masonry walls shall be provided with loose "T" anchors made from minimum of 16 gauge or adjustable jamb anchors of the strap and stirrup type made from the same thickness steel as the frame. Straps shall be no less than 2 in. x 10 in. in size, corrugated and/or perforated.
10. Grout guards shall be provided at hardware preparations, glazing stop screws and silencer preparations on frames to be set in masonry or concrete openings. Grout guards shall be sufficient to protect preparations from grout of a 4 in. maximum slump consistency which is hand troweled in place.
  - a. Glass stop screws shall be protected from grout by a steel threaded receptacle welded to the frame.
  - b. Door silencers (3 Glynn Johnson GJ64 silencers per door minimum) preparations shall be protected by steel grout guards.
11. Frames shall be provided with two (2) temporary steel spreaders welded to the bottom of the jambs to serve as bracing during shipping and handling. The installation contractor shall be responsible for finishing and touch-up of marks caused by spreader removal.
12. Removable lock cover plate to be on the hinge side, unless door swings into a room and there is no other access to the room, then removable lock cover plate is to be on the stop side.

- 1 13. Provide grout openings for vertical hollow metal frames sections that are not accessible for grouting  
2 due to steel lintels or other obstructions. The General Contractor shall provide for filling grout  
3 openings and finishing.  
4 14. Provide separate conduit systems for door control, intercom, etc., within hollow metal frames.

5 2.4 CLEARANCES AND TOLERANCES

6 A. Edge clearances for swinging doors shall not exceed the following:

- 7 1. Between doors and frames at head and jambs: 1/8 in.  
8 2. At door sills where a threshold is used: 3/8 in.  
9 3. At door sills where no threshold is used: 3/4 in.  
10 4. Install fire-rated doors in accordance with NFPA Standard No. 80.

11 B. Manufacturing tolerance shall be maintained within the following limits:

- 12 1. Frames for single door or pair of doors: Width, measured between rabbets at the head: Nominal  
13 opening width  $\pm 1/16$  in.,  $-1/32$  in.. Height (total length of jamb rabbet): Nominal opening height  $\pm$   
14  $3/64$  in.. Cross sectional profile dimensions:  
15 a. Face  $\pm 1/32$  in.  
16 b. Stop  $\pm 1/32$  in.  
17 c. Rabbet  $\pm 1/32$  in.  
18 d. Depth  $\pm 1/32$  in.  
19 e. Throat  $\pm 1/16$  in.  
20 f. Flatness of large frames  $1/8$  in. in 10 ft. of length or width  
21 2. Swinging door:  
22 a. Width  $\pm 3/64$  in.  
23 b. Height  $\pm 3/64$  in.  
24 c. Thickness  $\pm 1/16$  in.  
25 d. Hardware cutout dimensions Template dimensions  
26  $+0.015$  in. - 0 in.  
27 e. Hardware location  $\pm 1/32$  in.  
28 f. Bow/ flatness  $\pm 1/8$  in.

29 2.5 FINISH

- 30 A. After fabrication, doors and frames shall be thoroughly cleaned, degreased, bonderized and provided with  
31 one coat of primer.  
32 B. Shop Applied Primer: Manufacturer's standard rust inhibitive enamel. Verify compatibility with finish  
33 coats as specified in Section 09900, Painting. If compatibility is not ascertained during the bidding period,  
34 Contractor shall provide primer as specified in Section 09900, Painting.

35 2.6 ELECTRICAL REQUIREMENTS

- 36 A. Detention hollow metal fabricator shall furnish and install junction boxes and conduit between junction  
37 boxes in door frames for electrical locks, door position switches, and intercom call stations; coordinate  
38 special hardware requirements with the Electrical Contractor.  
39 B. See the Detention Hardware Schedule, the Detention Hollow Metal Door Schedules, and Details.  
40

## 2.7 DETENTION EQUIPMENT ACCESSORIES

- A. Provide accessories, anchorage inserts and security fasteners for a complete, tamperproof installation.
- B. Exposed Security Fasteners:
  - 1. Provide torx-head (star design with center pin) security fasteners for anchoring work in exposed detention areas. Comply with specification section 11199.
  - 2. Finish shall match that specified of the item anchored.

## PART 3 - EXECUTION

## 3.1 INSPECTION

- A. Examine the areas and conditions under which Detention Hollow Metal Doors and Frames are to be installed. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Expenses carried by the Architect/Engineer and Owner in troubleshooting detention hollow metal doors and frames problems caused by inadequate workmanship or other form of poor performance on the part of a contractor, shall be borne by that Contractor.
- B. Install Detention Hollow Metal Doors and Frames in accordance with shop drawings, manufacturer's written installation instructions, and as herein specified.
- C. Place detention hollow metal frames prior to construction of enclosing walls. Set frames accurately in position, plumbed and aligned (using metal shims), and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
- D. Prior to installation, frames shall be checked for size, and swing, and with temporary spreaders removed, corrected for squareness, alignment, twist and plumb. Permissible installation tolerances shall not exceed the following:
  - 1. Squareness  $\pm 1/16$  in.: Measured on a line, from jamb perpendicular to frame head.
  - 2. Alignment  $\pm 1/16$  in.: Measured at jambs on a horizontal line parallel to the plane of the face.
  - 3. Twist  $\pm 1/16$  in.: Measured at opposite face corners of jambs on parallel lines, perpendicular to the plane of the door rabbet.
  - 4. Plumb  $\pm 1/16$  in.: Measured at jambs on a perpendicular line from the head to the floor.
  - 5. The use of a Bi-Directional level is highly recommended (West Coast Industries - 14900 Whitman Ave. N. Seattle, WA 98133 - 206-365-7513) to achieve required tolerances. Standard masonry or carpenter levels are not normally calibrated to achieve the required tolerances.
- E. Install fire-rated frames in accordance with NFPA Standard No. 80.
- F. Grout fill solid detention hollow metal frame jambs, sill and head sections. Sill shall be packed solid with mortar before setting of frame. Provide grout openings in detention hollow metal frames where access to fill frames may be restricted due to steel lintels or other obstructions.
- G. Touch-up painting of factory finished or factory primed items is the Installer's responsibility.

- 1 H. Fill voids between materials of the detention equipment and embeds or other physical construction with  
2 low-mod gel, equal to Sikadur 23, by Sika and paint equipment to match surrounding materials.

3 3.3 ADJUSTMENT AND CLEANING

- 4 A. Check and readjust Detention Hollow Metal Doors and Frames just prior to final inspection. Leave work in  
5 complete and proper operating condition. Remove and replace defective work, including doors or frames  
6 which are warped, bowed or otherwise damaged.

- 7 B. Clean equipment thoroughly prior to Substantial Completion.

8 3.4 PROTECTION

- 9 A. Protect equipment and finishes until Substantial Completion.

- 10 B. Replace damaged equipment as directed by the Architect.

11 END OF SECTION 08322

1 SECTION 083613 - SECTIONAL DOORS

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Electrically operated sectional overhead doors.

6 B. Related Requirements:

- 7 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

8 1.2 ACTION SUBMITTALS

9 A. Product Data: For each type and size of sectional door and accessory.

- 10 1. Include construction details, material descriptions, dimensions of individual components, profile  
11 door sections, and finishes.  
12 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished  
13 accessories.

14 B. Shop Drawings: For each installation and for special components not dimensioned or detailed in  
15 manufacturer's product data.

- 16 1. Include plans, elevations, sections, and mounting details.  
17 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of  
18 field assembly, components, and location and size of each field connection.  
19 3. Include points of attachment and their corresponding static and dynamic loads imposed on  
20 structure.  
21 4. Include diagrams for power, signal, and control wiring.

22 C. Samples for Initial Selection: For units with factory-applied finishes.

- 23 1. Include Samples of accessories involving color selection.

24 D. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.

25 1.3 INFORMATIONAL SUBMITTALS

26 A. Qualification Data: For Installer.

27 B. Sample Warranties: For special warranties.

28 1.4 CLOSEOUT SUBMITTALS

29 A. Maintenance Data: For sectional doors to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
- b. Failure of components or operators before reaching required number of operation cycles.
- c. Faulty operation of hardware.
- d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
- e. Delamination of exterior or interior facing materials.

2. Warranty Period: Five years from date of Substantial Completion.

- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction.

- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Drawings.

2. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

- a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.

- b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.



## 2.3 SECTIONAL DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Series 596 with Model RHX® operator, or comparable products by one of the following:
- a. Clopay Building Products.
- b. Raynor.
- c. Wayne-Dalton Corp.
- B. Operation Cycles: Door components and operators capable of operating for not less than 25,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. U-Value: .057 Btu/sq. ft. x h x deg F
- D. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G90 zinc coating.
1. Door Section Thickness: 2 inches.
2. Section Faces:
- a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
- b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
- 1) Steel Sheet Thickness: 20 gauge galvanized.
- 2) Surface: Manufacturer's standard, flush, textured.
- c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material.
3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 16 gauge with thermal break.
4. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:
- a. Board Insulation: Polyurethane, secured to exterior face sheet.
- E. Track Configuration: Low Headroom, 2-inch track.
1. Mounting: Bracket-mounted.
2. Supporting Structure: Provide supplemental framing to accommodate loads and mounting requirements for spring anchors.
- F. Weatherseals: Fitted to bottom and top of door. Provide combination bottom weatherseal and sensor edge.
- G. Roller-Tire Material: Manufacturer's standard.

- H. Locking Devices: Equip door with slide bolt for padlock and chain lock keeper.
- I. Counterbalance Type: Manufacturer's standard; with post-tension drums.
- J. Electric Door Operator:
1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
  2. Operator Type: Manufacturer's standard for door requirements, side mounted.
  3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.4 m) or lower.
  4. Motor Exposure: Exterior, dusty, wet, or humid.
  5. Emergency Manual Operation: Chain type.
  6. Obstruction-Detection Device: Automatic electric sensor edge on bottom section.
- a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
7. Control Station: Where indicated on Drawings.
  8. Other Equipment: Audible and visual signals and portable, radio-control system.
- K. Door Finish:
1. Powder-Coat Finish: Color matching RAL 7047 as approved by Architect.
  2. Finish of Interior Facing Material: Match finish of exterior section face.
- 2.4 MATERIALS, GENERAL
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 2.5 TRACKS, SUPPORTS, AND ACCESSORIES
- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
1. Galvanized Steel: ASTM A 653/A 653M, minimum G60 (Z180) zinc coating.
  2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
  3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device.
- a. For Vertical Track: Continuous reinforcing angle attached to track and attached to wall with jamb brackets; or intermittent, jamb brackets attached to track and attached to wall.
- b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

## 2.6 HARDWARE

- A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- (2.01-mm-) nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet (4.88 m) wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.

## 2.7 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
- B. Chain Lock Keeper: Suitable for padlock.
- C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

## 2.8 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet (4.88 m) long and two additional brackets at one-third points to support shafts more than 16 feet (4.88 m) long unless closer spacing is recommended by door manufacturer.
- C. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
- D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

## 2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Comply with NFPA 70.
  2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
1. Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated.
1. Electrical Characteristics: Coordinated with building power.
  2. Motor Size: As recommended by manufacturer for conditions of application and to accommodate weight of door and glazing; large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
  3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
  4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
  5. Use adjustable motor-mounting bases for belt-driven operators.
- E. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom section. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure, push-button control labeled "Close."
1. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).

- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- L. Portable, Radio-Control System: Consisting of two of the following for each door. Include radio control manufacturer's universal receivers paired with remote controls, to provide optimal range for remote controller, and to mitigate interference at Project site.
  - 1. Three-channel universal coaxial receiver to open, close, and stop door.
  - 2. Portable control device to open and stop door may be momentary-contact type; control to close door shall be sustained- or constant-pressure type.
  - 3. Remote antenna and mounting kit.
- M. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
  - 1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness
  - 2. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
  - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.

2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

- D. Power-Operated Doors: Install according to UL 325.

### 3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

### 3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

- B. Lubricate bearings and sliding parts as recommended by manufacturer.

- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

- D. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780/A 780M.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for punched openings.
3. Exterior and interior manual-swing entrance doors.

## 1.2 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

## B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
  - a. Joinery, including concealed welds.
  - b. Anchorage.
  - c. Expansion provisions.
  - d. Glazing.
  - e. Flashing and drainage.
3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams showing the following:
  - a. Power requirements for each electrically operated door hardware.
  - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

## C. Samples for Initial Selection: For units with factory-applied color finishes.

## D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

## E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

## F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and field testing agency.
- B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
  - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency, or by manufacturer and witnessed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

## 1.6 MOCKUPS

- A. Mockups: Build mockups to set quality standards for installation.
  - 1. Build mockup of typical punched opening as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.



## 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures, including, but not limited to, excessive deflection.
- b. Noise or vibration created by wind and thermal and structural movements.
- c. Deterioration of metals and other materials beyond normal weathering.
- d. Water penetration through fixed glazing and framing areas.
- e. Failure of operating components.

2. Warranty Period: 2 years from date of Substantial Completion.

- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing sliding windows and accessories, from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

- a. Thermal stresses transferring to building structure.
- b. Glass breakage.
- c. Noise or vibration created by wind and thermal and structural movements.

- 1 d. Loosening or weakening of fasteners, attachments, and other components.
- 2 e. Failure of operating units.
- 3 C. Structural Loads:
- 4 1. Wind Loads: As indicated on Drawings.
- 5 2. Other Design Loads: As indicated on Drawings.
- 6 D. Deflection of Framing Members: At design wind pressure, as follows:
- 7 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass
- 8 plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount
- 9 that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
- 10 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm),
- 11 whichever is smaller; or amount not exceeding that which reduces glazing bite to less than 75
- 12 percent of design dimension and that which reduces edge clearance between framing members and
- 13 glazing or other fixed components to less than 1/8 inch (3.2 mm).
- 14 a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing
- 15 members and operable units.
- 16 E. Structural: Test according to ASTM E 330/E 330M as follows:
- 17 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including
- 18 entrance doors, do not evidence deflection exceeding specified limits.
- 19 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront
- 20 assemblies, including entrance doors and anchorage, do not evidence material failures, structural
- 21 distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
- 22 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- 23 F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
- 24 1. Fixed Framing and Glass Area:
- 25 a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure
- 26 differential of 6.24 lbf/sq. ft. (300 Pa).
- 27 2. Entrance Doors:
- 28 a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-
- 29 pressure differential of 1.57 lbf/sq. ft. (75 Pa).
- 30 G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
- 31 1. No evidence of water penetration through fixed glazing and framing areas, including entrance
- 32 doors, when tested according to a minimum static-air-pressure differential of 20 percent of
- 33 positive wind-load design pressure, but not less than 8 lbf/sq. ft. (383 Pa).
- 34 H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature
- 35 changes.
- 36 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.3 STOREFRONT SYSTEMS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide the following products by Kawneer North America, an Arconic company:
- Exterior Storefront Framing Systems: Trifab® VersaGlaze 451T.
  - Interior Storefront Framing Systems: Trifab® 400.
- B. Comparable Products: Subject to compliance with requirements, provide the basis-of-design products indicated, or comparable products by one of the following:
- EFCO Corporation.
  - Oldcastle Building Envelope.
- C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
- Exterior Framing Construction: Thermally broken.
  - Interior Vestibule Framing Construction: Nonthermal.
  - Glazing System: Retained mechanically with gaskets on four sides.
  - Glazing Plane: As indicated.
  - Finish: High-performance organic finish.
  - Fabrication Method: Field-fabricated stick system.
  - Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  - Steel Reinforcement: As required by manufacturer.
- D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

## 2.4 ENTRANCE DOOR SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; AA™ 425 Thermal Entrance Doors, or comparable product by one of the following:
- EFCO Corporation.
  - Oldcastle Building Envelope.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
- Door Construction: 2- to 2-1/4-inch (50.8- to 57.2-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
    - Thermal Construction: Thermal breaks in door, frame and threshold separate aluminum members exposed to the exterior from members exposed to the interior; double air cavity stile and rail design; dual perimeter weather seals; and low conductance polymer door stop.
  - Door Design: Wide stile and mid-rail; 4-1/4-inch (108-mm) nominal width.
  - Bottom Rail Height: 10 inches (254 mm).

4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

## 2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000 molded neoprene or ASTM D 2287 molded PVC.

2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

## 2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

## 2.7 MATERIALS

A. Sheet and Plate: ASTM B 209 (ASTM B 209M).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).

C. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.

D. Structural Profiles: ASTM B 308/B 308M.

E. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.

2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.

3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

## 2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

2. Reinforce members as required to receive fastener threads.
  3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, complying with ASTM A 240/A 240M, of type recommended by manufacturer.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- E. Rigid PVC Filler.

## 2.9 AUXILIARY COMPONENTS

- A. Fillers, Trim and Closures: Provide filler panels, trim, cover plates, and other closures, for both exterior and interior conditions as shown, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of storefront due to thermal expansion and building deflections, as indicated.
1. Fabricate fillers, trim and closures from extruded aluminum unless otherwise indicated; fabricate from brake metal where indicated.
  2. Exposed Finish: Match storefront framing.
- B. Sills: Provide sills of profile and dimensions indicated but not less than 0.125-inch-thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners.
1. Exposed Finish: Match storefront framing.

## 2.10 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
  2. Accurately fitted joints with ends coped or mitered.
  3. Physical and thermal isolation of glazing from framing members.
  4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  5. Provisions for field replacement of glazing from interior.
  6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.

2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.11 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range, unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

### 3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.

2. Do not install damaged components.

3. Fit joints to produce hairline joints free of burrs and distortion.

4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

### 3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:
  - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
  - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
  - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

### 3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
  - a. Perform a minimum of three tests in areas as directed by Architect.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

1 D. Prepare test and inspection reports.

2 END OF SECTION 084113



1 SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section includes conventionally glazed aluminum curtain walls installed as stick and unitized assemblies.

8 B. Related Sections:

- 9 1. Section 079200 "Joint Sealants" for installation of joint sealants installed with glazed aluminum  
10 curtain walls and for sealants to the extent not specified in this Section.

11 1.3 PERFORMANCE REQUIREMENTS

- 12 A. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis  
13 by a qualified professional engineer, using performance requirements and design criteria indicated.

- 14 B. General Performance: Comply with performance requirements specified, as determined by  
15 manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project  
16 without failure due to defective manufacture, fabrication, installation, or other defects in construction.

- 17 1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not  
18 limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly  
19 distributed and concentrated live loads.

- 20 2. Failure also includes the following:

- 21 a. Thermal stresses transferring to building structure.  
22 b. Glass breakage.  
23 c. Noise or vibration created by wind and thermal and structural movements.  
24 d. Loosening or weakening of fasteners, attachments, and other components.  
25 e. Failure of operating units.

26 C. Structural Loads:

- 27 1. Wind Loads: As indicated on Drawings  
28 2. Other Design Loads: As indicated on Drawings

- 29 D. Structural-Test Performance: Provide glazed aluminum curtain-wall systems tested according to  
30 ASTM E 330 as follows:

- 31 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection  
32 exceeding specified limits.  
33 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including  
34 anchorage, do not evidence material failures, structural distress, and permanent deformation of main  
35 framing members exceeding 0.2 percent of span.  
36 3. Test Duration: As required by design wind velocity but not less than 10 seconds.

## E. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

## F. Thermal Movements: Provide glazed aluminum curtain-wall systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.
2. Test Interior Ambient Air Temperature: 75 degrees F.
3. Test Performance: No buckling, stress on glass, glazing-edge seal failure, sealant failure, excess stress on curtain-wall framing, anchors and fasteners, or reduction of performance when tested according to AAMA 501.5.

## G. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.

1. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 psf.
2. Condensation Resistance: When tested to AAMA Specification 1503, the Condensation Resistance Factor shall not be less than 66 (frame) and 60 (glass-clear).

## H. Water Penetration Under Static Pressure: Provide aluminum glazed curtain-wall systems that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 20 percent of positive design wind load, but not less than 10 lbf/sq. ft.

## I. Average Thermal Conductance: Provide glazed aluminum curtain-wall systems with average U-factor of not more than 0.66 Btu/sq. ft. x h x degrees F when tested according to AAMA 1503.

## J. Sound Transmission Loss: When tested to ASTM E90 and ASTM E1425, the Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) shall not be less than STC 31 or OITC 26 based upon 1" insulating glass (1/4", 1/2" AS, 1/4").

## 1.4 ACTION SUBMITTALS

## A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

## B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
  - a. Joinery, including concealed welds.
  - b. Anchorage.
  - c. Expansion provisions.
  - d. Glazing.
  - e. Flashing and drainage.

- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For qualified Installer.
- F. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
  - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.
- H. Field quality-control reports.
- I. Warranties: Sample of special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.
- C. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
  - 1. Provide NFRC-certified glazed aluminum curtain walls with an attached label.

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating glazed aluminum curtain-wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

## 1.7 WARRANTY

- A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
- b. Noise or vibration created by wind and thermal and structural movements.
- c. Water penetration through fixed glazing and framing areas.
- d. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer 1600 Wall as manufactured by Kawneer North America; an Alcoa company or comparable product by one of the following:

1. EFCO Corporation.
2. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.

## 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

## 2.3 FRAMING

- A. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.

- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

- D. Anchors: Three-way adjustable anchors with minimum adjustment that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

- F. Framing Sealants: Manufacturer's standard sealants.

## 2.4 GLAZING SYSTEMS

- A. Glazing: Comply with Section 088000 "Glazing."

- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

## 2.5 ACCESSORY MATERIALS

- A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

## 2.6 FABRICATION

- A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
7. Components curved to indicated radii.

D. Fabricate components that, when assembled, have the following characteristics:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Seal joints watertight unless otherwise indicated.
3. Install glazing to comply with requirements in Division 08 Section "Glazing."

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.7 ALUMINUM FINISHES

A. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

## 3.2 INSTALLATION

## A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal joints watertight unless otherwise indicated.

## B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

## C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

## D. Install components plumb and true in alignment with established lines and grades.

## E. Install glazing as specified in Section 088000 "Glazing."

## 3.3 ERECTION TOLERANCES

## A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
3. Alignment:
  - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
  - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
  - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

## END OF SECTION 084413

1 SECTION 085653 - SECURITY WINDOWS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Vision security windows.  
9 2. Fixed, transacted security windows.  
10 3. Modular, sliding transacted security windows.

11 1.3 COORDINATION

- 12 A. Coordinate installation of anchorages for security windows. Furnish setting drawings, templates, and  
13 directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with  
14 integral anchors, that are to be embedded in adjacent construction. Deliver such items to Project site in  
15 time for installation.

16 1.4 ACTION SUBMITTALS

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

- 18 1. Include construction details, material descriptions, dimensions of individual components and  
19 profiles, weights and finishes for window units.

- 20 B. Shop Drawings: For security windows.

- 21 1. Include plans, elevations, sections, and attachment details.  
22 2. Full-size section details of framing members, including internal armoring, reinforcement, and  
23 stiffeners.  
24 3. Location of weep holes.  
25 4. Hardware for sliding window units.  
26 5. Glazing details.  
27 6. Details of transacted counter and speaking aperture.

- 28 C. Samples for Initial Selection: For frame members with factory-applied color finishes.

29 1.5 INFORMATIONAL SUBMITTALS

- 30 A. Welding certificates.



- B. Product Test Reports: For each type of security window and accessory indicated as ballistics resistant, for tests performed by a qualified testing agency.
- C. Configuration Disclosure Drawing: For each type of forced-entry-resistant security window, complying with ASTM F1233.
- D. Examination reports documenting inspections of substrates, areas, and conditions.
- E. Anchor inspection reports documenting inspections of built-in and cast-in anchors.
- F. Field quality-control reports documenting inspections of installed products.
  - 1. Field quality-control certification signed by Contractor.
- G. Sample Warranty: For special warranty.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
  - 4. AWS D1.6, "Structural Welding Code - Stainless Steel."

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.
- B. Label security window packaging with drawing designation.
- C. Store crated security windows on raised blocks to prevent moisture damage.

#### 1.8 FIELD CONDITIONS

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

#### 1.9 SEQUENCING

#### 1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:

- a. Structural failures including deflections exceeding 1/4 inch.
- b. Failure of welds.
- c. Excessive air leakage.
- d. Faulty operation of sliding window hardware.
- e. Faulty operation of transaction drawers.
- f. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:

1. Ballistics Resistance: Level 3 when tested according to UL 752.
2. Forced-Entry Resistance: Level III when tested according to HPW-TP-0500.03.

### 2.2 VISION SECURITY WINDOWS

- A. Provide vision security windows with framing on four sides and no operable sash or ventilator.

- B. Basis of Design:

1. Subject to compliance with requirements, provide products by the following:

- a. Total Security Solutions, Inc., 935 Garden Lane, Fowlerville, MI 48836, 866 734-6277.  
Attn: Sales Department, sales@tssbulletproof.com. Web: www.tssbulletproof.com

- 1) Product shall be: TSS Hole and Backer Window.

- C. Bullet Resistant Hole and Backer Window:

1. The Hole and Backer System shall consist of custom prefabricated bullet resistant panels with secure air passage as required for voice transmission.
2. All accessories required for installation shall be included
3. Window Dimensions shall be in sizes as indicated on Drawings.
4. Glazing Panels shall be in sizes as indicated on Drawings.
5. Bullet-Resisting Glazing Material:

- a. Bullet Resistant Level 3:

- 1) 1 1/4" LP 1250 Laminated
- 2) 1 1/4" All Poly 1250
- 3) 1 1/4" TSS-003 L/S Glass Clad

6. Glazing Channel shall be a U-Channel specifically designed for securing glazing tightly in place.
7. Angles and shall only be acceptable for top attachment.
8. Frame shall be 18 ga. stainless steel.
9. The bottom of the glazing shall be capped with corresponding material on the frame.

## 2.3 FIXED, TRANSACTION SECURITY WINDOWS

A. Provide vision security windows with framing on four sides and no operable sash or ventilator.

B. Basis of Design:

1. Subject to compliance with requirements, provide products by the following:

a. Total Security Solutions, Inc., 935 Garden Lane, Fowlerville, MI 48836, 866 734-6277.  
Attn: Sales Department, sales@tssbulletproof.com. Web: www.tssbulletproof.com

1) Product shall be: TSS Hole and Backer Transaction Window.

C. Bullet Resistant Hole and Backer Transaction Window:

1. The Hole and Backer System shall consist of custom prefabricated bullet resistant panels with secure air passage as required for voice transmission.

2. All accessories required for installation shall be included

3. Window Dimensions shall be in sizes as indicated on Drawings.

4. Glazing Panels shall be in sizes as indicated on Drawings.

5. Bullet-Resisting Glazing Material:

a. Bullet Resistant Level 3:

1) 1 1/4" LP 1250 Laminated

2) 1 1/4" All Poly 1250

3) 1 1/4" TSS-003 L/S Glass Clad

6. Cash tray: Provide Brushed Stainless Steel Recessed.

a. Cash tray shall be constructed of 18 gauge stainless steel, # 4 finish

b. Size: 16" x 8" from the outside edge of flanges with a clear opening

7. Provide a shelf 1 1/2" thick with recessed cash tray.

a. Shelf shall be full width of window by 18" deep, centered under glazing and covered with stainless steel 18 ga. #4 finish.

8. Glazing Channel shall be a U-Channel specifically designed for securing glazing tightly in place.

9. Angles and shall only be acceptable for top attachment.

10. Frame shall be 18 ga. stainless steel.

11. The bottom of the glazing shall be capped with corresponding material on the frame.

## 2.4 MODULAR SLIDING, TRANSACTION SECURITY WINDOWS

A. Manufacturer:

1. Ready Access, Inc., 1815 Arthur Drive, West Chicago, Illinois 60185. Toll Free (800) 621-5045.  
Phone (630) 876-7766. Fax (630) 876-7767. Web Site www.ready-access.com. E-Mail ready@ready-access.com. Configuration:

a. Product shall be: Modular Security Drive-Thru Windows; 600 Series Flush-Mount Window.

B. Flush-Mount Security Windows:

1. One fixed-glazed panel and one horizontal-sliding glazed panel

2. Window Dimensions: 47-1/2 inches wide by 43-1/2 inches high by 4-1/2 inches deep.

3. Service Panel Operation: Manual open/self closing.

4. Service Panel Type: Sliding, 1 panel.
5. Opening Direction: Right to left. (Customer View-Outside)
6. Frame: Extruded aluminum, ASTM B 221, Alloy 6063-T6.
7. Aluminum Sheet: ASTM B 209, Alloy 5005-AQ-H34.
8. Galvanized Steel Sheet: ASTM A 653, G90.
9. Security: Self-latches each time panel closes. Deadbolt lock.
10. Fasteners: Stainless steel rivets and hex-head zinc-plated self-threading machine screws.
11. Handle: Stainless steel.
12. Lock: Self-latching Adams Rite MS1847 Series with Adams Rite 1000 Series turn. Adams Rite MS1850 Series with Adams Rite 4066 Series mortise thumbturn.
13. Glazing:
  - a. 3/4-inch GE Lexgard RC-750 Laminate. 3-ply clear, extruded Lexan polycarbonate laminate with Margard surface. Forced-entry protection security glazing, ASTM F 1233.
14. Silicone Glazing Sealant: Dow Corning 999A, aluminum

## 2.5 FABRICATION

- A. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.
  1. Provide units that are reglazable from the secure side without dismantling the attack side of framing.
  2. Prepare security windows for field glazing unless preglazing at the factory is indicated.
- B. Provide weep holes and internal water passages for exterior security windows to conduct infiltrating water to the exterior.
- C. Thermally Improved or Thermally Broken Construction: Fabricate framing with an integral, concealed, low-conductance thermal barrier, located between exterior materials and members exposed on interior in a manner that eliminates direct metal-to-metal contact.
- D. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.
  1. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.
- E. Glazing Stops: Finish glazing stops to match security window framing.
  1. Attack-Side (Exterior) Glazing Stops: Welded or integral to framing.
  2. Secure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.
- F. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- G. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- H. Factory-cut openings in glazing for speaking apertures.
- I. Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated. Installation orientation of glazing to meet performance requirements. Comply with requirements in Section 088853 "Security Glazing."

J. Weather Stripping: Factory applied.

## 2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.8 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.

2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3. Directional Satin Finish: No. 4.

## 2.9 ACCESSORIES

A. Speaking Apertures: Fabricate from security glazing, designed to allow passage of speech at normal speaking volume without distortion.

1. Shape: Circular.

2. Ballistics Resistance: Same as security window.

3. Listed and labeled as bullet resisting according to UL 752.

B. Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.

C. Cast-in-Place Anchors in Concrete: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E488/E488M, conducted by a qualified testing agency; of type indicated below.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A27/A27M cast steel or ASTM A47/A47M malleable iron. Provide bolts, washers, and shims as required; hot-dip galvanized according to ASTM A153/A153M or ASTM F2329/F2329M.

- 1 D. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum 3/16 inch thick; with  
2 minimum 1/2-inch-diameter, headed studs welded to back of plate.
- 3 E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- 4 F. Glazing Strips and Weather Stripping: Manufacturer's standard replaceable components.
- 5 1. Compression Type: Molded EPDM or neoprene gaskets complying with ASTM D2000,  
6 Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D2287; or  
7 molded, expanded EPDM or neoprene gaskets complying with ASTM C509, Grade 4.
- 8 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-  
9 fabric backing.
- 10 G. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass  
11 manufacturers and with a proven record of compatibility with surfaces contacted in installation.
- 12 1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
- 13 2. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- 14 3. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required  
15 by glass manufacturer to maintain glass lites in place for installation indicated.
- 16 4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side  
17 walking).
- 18 H. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying  
19 with ASTM B633; provide sufficient strength to withstand design pressures indicated.
- 20 I. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- 21 J. Sealants: For sealants required within fabricated security windows, provide type recommended by  
22 manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and  
23 nonmigrating.

## 24 PART 3 - EXECUTION

### 25 3.1 EXAMINATION

- 26 A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for  
27 installation tolerances and other conditions affecting performance of security windows.
- 28 B. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window  
29 connections before security window installation.
- 30 C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of security  
31 windows.
- 32 D. Inspect built-in and cast-in anchor installations, before installing security windows, to verify that anchor  
33 installations comply with requirements. Prepare inspection reports.
- 34 1. Remove and replace anchors where inspections indicate that they do not comply with specified  
35 requirements. Reinspect after repairs or replacements are made.
- 36 2. Perform additional inspections to determine compliance of replaced or additional work. Prepare  
37 anchor inspection reports.

E. For factory-installed glazing materials whose orientation (secure or attack side) is critical for performance, verify installation orientation.

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

### 3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other security window anchors whose installation is specified in other Sections.

1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

### 3.3 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.

1. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same forced-entry-resistance and ballistics-resistance performance as security window.

B. Voice-Communication-Type Framing: Attach removable glass spacers to jambs and head of glazing, located not more than 6 inches from each corner and spaced not more than 12 inches o.c.

C. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. Provide stainless-steel fasteners in stainless-steel materials.

D. Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.

1. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
2. Seal frame perimeter with sealant to provide weathertight construction unless otherwise indicated.

E. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

### 3.4 FIELD QUALITY CONTROL

A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

B. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.

C. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

1    3.5        ADJUSTING

2        A.        Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth  
3                    operation and a secure enclosure.

4        B.        Remove and replace defective work, including security windows that are warped, bowed, or otherwise  
5                    unacceptable.

6    3.6        CLEANING AND PROTECTION

7        A.        Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish.  
8                    Remove excess glazing and sealant compounds, dirt, and other substances.

- 9                    1.        Lubricate sliding security window hardware.  
10                    2.        Lubricate transaction drawer hardware.

11        B.        Clean glass of preglazed security windows promptly after installation. Comply with requirements in  
12                    Section 088853 "Security Glazing" for cleaning and maintenance.

13        C.        Provide temporary protection to ensure that security windows are without damage at time of Substantial  
14                    Completion.

15    END OF SECTION 085653



## 1 SECTION 087100 - DOOR HARDWARE

## 2 PART 1 - GENERAL

## 3 1.01 SUMMARY

## 4 A. Section includes:

- 5 1. Mechanical and electrified door hardware
- 6 2. Electronic access control system components

## 7 B. Section excludes:

- 8 1. Windows
- 9 2. Cabinets (casework), including locks in cabinets
- 10 3. Signage
- 11 4. Toilet accessories
- 12 5. Overhead doors

## 13 C. Related Sections:

- 14 1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished
- 15 Contractor Installed, Project Management and Coordination.
- 16 2. Division 06 Section "Rough Carpentry"
- 17 3. Division 06 Section "Finish Carpentry"
- 18 4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation
- 19 specified in this section.
- 20 5. Division 08 Sections:
- 21 a. "Metal Doors and Frames"
- 22 b. "Flush Wood Doors"
- 23 c. "Aluminum-Framed Entrances and Storefronts"
- 24 6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage
- 25 wiring.
- 26 7. Division 28 "Electronic Safety and Security" sections for coordination with other components of
- 27 electronic access control system and fire alarm system.

## 28 1.02 REFERENCES

## 29 A. UL LLC

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

## 34 B. DHI - Door and Hardware Institute

- 35 1. Sequence and Format for the Hardware Schedule
- 36 2. Recommended Locations for Builders Hardware
- 37 3. Keying Systems and Nomenclature
- 38 4. Installation Guide for Doors and Hardware

## C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

## D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

## 1.03 SUBMITTALS

## A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
  - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
  - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

## B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
  - a. Wiring Diagrams: For power, signal, and control wiring and including:
    - 1) Details of interface of electrified door hardware and building safety and security systems.
    - 2) Schematic diagram of systems that interface with electrified door hardware.
    - 3) Point-to-point wiring.
    - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
  - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
  - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.

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

5. Key Schedule:

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

C. Informational Submittals:

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

D. Closeout Submittals:

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

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
  - a. Fire door assemblies, in compliance with NFPA 80.
  - b. Required egress door assemblies, in compliance with NFPA 101.

#### 1.04 QUALITY ASSURANCE

##### A. Qualifications and Responsibilities:

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

##### B. Certifications:

1. Fire-Rated Door Openings:
  - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
  - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
2. Smoke and Draft Control Door Assemblies:
  - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
  - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
3. Electrified Door Hardware
  - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
4. Accessibility Requirements:

- a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

#### C. Pre-Installation Meetings

##### 1. Keying Conference

- a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
  - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - 2) Preliminary key system schematic diagram.
  - 3) Requirements for key control system.
  - 4) Requirements for access control.
  - 5) Address for delivery of keys.

##### 2. Pre-installation Conference

- a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- b. Inspect and discuss preparatory work performed by other trades.
- c. Inspect and discuss electrical roughing-in for electrified door hardware.
- d. Review sequence of operation for each type of electrified door hardware.
- e. Review required testing, inspecting, and certifying procedures.
- f. Review questions or concerns related to proper installation and adjustment of door hardware.

##### 3. Electrified Hardware Coordination Conference:

- a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

#### 1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

#### 1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
  - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
  - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    - a. Mechanical Warranty
      - 1) Locks
        - a) Schlage L Series: 10 years
        - b) Schlage ND Series: 10 years
      - 2) Exit Devices
        - a) Falcon: 10 years
      - 3) Closers
        - a) LCN 4050 Series: 25 years
    - b. Electrical Warranty
      - 1) Locks
        - a) Schlage: 3 year

#### 1.08 MAINTENANCE

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

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.

- 1 B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon  
2 those products providing all functions and features and meeting all requirements of scheduled  
3 manufacturer's product.
- 4 C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware,  
5 furnish suitable types having same operation and quality as type specified, subject to Architect's  
6 approval.

## 7 2.02 MATERIALS

### 8 A. Fabrication

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

- 18 B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware  
19 installation.

- 20 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

### 21 C. Cable and Connectors:

- 22 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire  
23 harnesses with number and gage of wires enough to accommodate electric function of specified  
24 hardware.
- 25 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and  
26 power transfer devices.
- 27 3. Provide through-door wire harness for each electrified locking device installed in a door and wire  
28 harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric  
29 power transfer for connection to power supplies.

## 30 2.03 HINGES

### 31 A. Manufacturers and Products:

- 32 1. Scheduled Manufacturer and Product:  
33 a. Ives 5BB series
- 34 2. Acceptable Manufacturers and Products:  
35 a. Hager BB1191/1279 series  
36 b. McKinney TB series

### 37 B. Requirements:

- 38 1. Provide hinges conforming to ANSI/BHMA A156.1.  
39 2. Provide five knuckle, ball bearing hinges.  
40 3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

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

## 22 2.04 CONTINUOUS HINGES

### 23 A. Manufacturers:

- 24 1. Scheduled Manufacturer:
- 25 a. Ives
- 26 2. Acceptable Manufacturers:
- 27 a. Select
- 28 b. Roton

### 29 B. Requirements:

- 30 1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
- 31 2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from
- 32 6063-T6 aluminum.
- 33 3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
- 34 4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for
- 35 1,500,000 cycles.
- 36 5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors
- 37 by testing agency acceptable to authority having jurisdiction.
- 38 6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware
- 39 sets. Provide with number and gage of wires enough to accommodate electric function of specified
- 40 hardware.
- 41 7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise
- 42 noted or door details require shorter length and with symmetrical hole pattern.

## 43 2.05 ELECTRIC POWER TRANSFER



## A. Manufacturers:

1. Scheduled Manufacturer and Product:
  - a. Von Duprin EPT-10
2. Acceptable Manufacturers and Products:
  - a. Securitron CEPT-10
  - b. Security Door Controls PTM

## B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

## 2.06 FLUSH BOLTS

## A. Manufacturers:

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

## B. Requirements:

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

## 2.07 COORDINATORS

## A. Manufacturers:

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

## B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes, or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

## 2.08 MORTISE LOCKS

## A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. Schlage L9000 series
2. Acceptable Manufacturers and Products:
  - a. Sargent 8200 series
  - b. Best 45H series

## B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-3/5-inch x 3/5 inch with 180-degree visibility. Provide messages color-coded using ANSI Z535 Safety Red with full text and/or symbols, as scheduled, for easy visibility. When applicable allows for lock status indication on both sides of the door.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
7. Provide motor based electrified locksets that comply with the following requirements:
  - a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
  - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
  - c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
  - d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
  - e. Connections – provide quick-connect Molex system standard.
8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
  - a. Lever Design: 06A.

## 2.09 CYLINDRICAL LOCKS – GRADE 1

## A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. Schlage ND series
2. Acceptable Manufacturers and Products:
  - a. Sargent 11-Line
  - b. Best Lock 9K series

## B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
  - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
  - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
  - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
  - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
  - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
3. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
  - a. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
  - b. Lever Design: <INSERT LEVER DESIGN>.

## 2.10 EXIT DEVICES

## A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. Falcon 24/25 series
2. Acceptable Manufacturers and Products:
  - a. Sargent 19-43-GL-80 series
  - b. Detex Advantex series

## B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.

9. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide electrified options as scheduled.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

## 2.11 ELECTRIC STRIKES

### A. Manufacturers and Products:

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

### B. Requirements:

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

## 2.12 POWER SUPPLIES

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. Schlage/Von Duprin PS900 Series
2. Acceptable Manufacturers and Products:
  - a. Sargent 3500 series
  - b. Dynalock 5000 series

### B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
  - a. 12/24 VDC Output, field selectable.
  - b. Class 2 Rated power limited output.

- c. Universal 120-240 VAC input.
- d. Low voltage DC, regulated and filtered.
- e. Polarized connector for distribution boards.
- f. Fused primary input.
- g. AC input and DC output monitoring circuit w/LED indicators.
- h. Cover mounted AC Input indication.
- i. Tested and certified to meet UL294.
- j. NEMA 1 enclosure.
- k. Hinged cover w/lock down screws.
- l. High voltage protective cover.

## 2.13 CYLINDERS

### A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product:
  - a. Schlage Everest 29 R
- 2. Acceptable Manufacturers and Products:
  - a. Best Preferred Patented
  - b. Sargent XC

### B. Requirements:

- 1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
- 2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
  - a. Patented Restricted Small Format: cylinder with small format interchangeable cores (SFIC) with restricted, patented keyway.
- 3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
- 4. Nickel silver bottom pins.

## 2.14 KEYING

### A. Scheduled System:

- 1. New factory registered system:
  - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

### B. Requirements:

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

- a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
  - 1) Master Keying system as directed by the Owner.
- b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
- c. Provide keys with the following features:
  - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
  - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
- d. Identification:
  - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
  - 2) Identification stamping provisions must be approved by the Architect and Owner.
  - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
  - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
  - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
- e. Quantity: Furnish in the following quantities.
  - 1) Permanent Control Keys: 3.
  - 2) Master Keys: 6.
  - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
  - 4) Key Blanks: Quantity as determined in the keying meeting.

## 2.15 KEY CONTROL SYSTEM

### A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Telkee
2. Acceptable Manufacturers:
  - a. HPC
  - b. Lund

### B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
  - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
  - b. Provide hinged-panel type cabinet for wall mounting.

## 2.16 DOOR CLOSERS

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
  - a. LCN 4050A series

## 2. Acceptable Manufacturers and Products:

- a. Falcon SC70A series
- b. Norton 7500 series

## B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

## 2.17 DOOR TRIM

## A. Manufacturers:

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

## B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

## 2.18 PROTECTION PLATES

## A. Manufacturers:

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

## B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.

2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

## 2.19 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

### A. Manufacturers:

1. Scheduled Manufacturers:
  - a. Glynn-Johnson
2. Acceptable Manufacturers:
  - a. Rixson
  - b. Sargent

### B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

## 2.20 DOOR STOPS AND HOLDERS

### A. Manufacturers:

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

### B. Provide door stops at each door leaf:

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

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

### A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Zero International
2. Acceptable Manufacturers:
  - a. National Guard
  - b. Reese

### B. Requirements:



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

## 2.22 SILENCERS

### A. Manufacturers:

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

### B. Requirements:

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

## 2.23 MAGNETIC HOLDERS

### A. Manufacturers:

1. Scheduled Manufacturer:
  - a. LCN
2. Acceptable Manufacturers:
  - a. Rixson
  - b. Sargent

### B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

## 2.24 DOOR POSITION SWITCHES

### A. Manufacturers:

1. Scheduled Manufacturer:
  - a. Schlage

- 1 2. Acceptable Manufacturers:
- 2 a. GE-Interlogix
- 3 b. Sargent
- 4 B. Requirements:
- 5 1. Provide recessed or surface mounted type door position switches as specified.
- 6 2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used
- 7 with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and
- 8 magnetic locking device.

## 9 2.25 FINISHES

### 10 A. FINISH: BHMA 626/652 (US26D); EXCEPT:

- 11 1. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
- 12 2. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
- 13 3. Protection Plates: BHMA 630 (US32D)
- 14 4. Overhead Stops and Holders: BHMA 630 (US32D)
- 15 5. Door Closers: Powder Coat to Match
- 16 6. Wall Stops: BHMA 630 (US32D)
- 17 7. Latch Protectors: BHMA 630 (US32D)
- 18 8. Weatherstripping: Clear Anodized Aluminum
- 19 9. Thresholds: Mill Finish Aluminum

## 20 PART 3 - EXECUTION

### 21 3.01 EXAMINATION

- 22 A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with
- 23 requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor
- 24 construction, and other conditions affecting performance. Verify doors, frames, and walls have been
- 25 properly reinforced for hardware installation.
- 26 B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections
- 27 before electrified door hardware installation.
- 28 C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory
- 29 conditions have been corrected.

### 30 3.02 INSTALLATION

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

- 1 C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using  
2 only fasteners provided by manufacturer.
- 3 D. Do not install surface mounted items until finishes have been completed on substrate. Protect all  
4 installed hardware during painting.
- 5 E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as  
6 necessary for proper installation and operation.
- 7 F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and  
8 anchors according to industry standards.
- 9 G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive  
10 clearance.
- 11 H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity  
12 recommended by manufacturer for application indicated.
- 13 I. Lock Cylinders:
- 14 1. Install construction cores to secure building and areas during construction period.  
15 2. Furnish permanent cores to Owner for installation.
- 16 J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND  
17 SECURITY sections for:
- 18 1. Conduit, junction boxes and wire pulls.  
19 2. Connections to and from power supplies to electrified hardware.  
20 3. Connections to fire/smoke alarm system and smoke evacuation system.  
21 4. Connection of wire to door position switches and wire runs to central room or area, as directed by  
22 Architect.  
23 5. Connections to panel interface modules, controllers, and gateways.  
24 6. Testing and labeling wires with Architect's opening number.
- 25 K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as  
26 determined by final keying schedule.
- 27 L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so  
28 that the hinge does not cover the label once installed.
- 29 M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of  
30 exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not  
31 visible in corridors, lobbies and other public spaces unless approved by Architect.
- 32 N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of  
33 exterior doors, and stair side of stairway doors.
- 34 O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in  
35 equipment room, or alternate location as directed by Architect.
- 36 P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07  
37 Section "Joint Sealants."
- 38 Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware  
39 schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

- R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

### 3.03 ADJUSTING

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

### 3.04 CLEANING AND PROTECTION

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

### 3.05 DOOR HARDWARE SCHEDULE

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

## 1 Hardware Group No. 01

2	3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
	1	EA	PRIVACY LOCK	L9040 06A 09-544 L283-722	626	SCH
	1	EA	SURFACE CLOSER	4050A RW/PA	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	WALL STOP	WS406/407CCV	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER

3

## 4 Hardware Group No. 02

5	3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
	1	EA	PRIVACY LOCK	L9040 06A 09-544 L283-722	626	SCH
	1	EA	OH STOP	100S	652	GLY
	1	EA	SURFACE CLOSER	4050A RW/PA ST-5003	689	LCN
	1	EA	MOUNTING PLATE	4050A-18 SRT	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER

6

## 7 Hardware Group No. 03

8	3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
	1	EA	PRIVACY LOCK	ND40S RHO	626	SCH
	1	EA	OH STOP	100S	652	GLY
	1	EA	GASKETING	488SBK PSA	BK	ZER

9

## 10 Hardware Group No. 04

11	3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
	1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
	1	EA	PULL PLATE	8302 10" 4" X 16"	630	IVE
	1	EA	SURFACE CLOSER	4050A RW/PA	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	WALL STOP	WS406/407CCV	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER

12

## 13 Hardware Group No. 05

14	3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
	1	EA	CLASSROOM LOCK	ND70HD RHO	626	SCH
	1	EA	SFIC EVEREST CORE	80-037	613	SCH
	1	EA	SURFACE CLOSER	4050A RW/PA	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	WALL STOP	WS406/407CCV	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER

15

## 1 Hardware Group No. 06

2	3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
	1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
	1	EA	SFIC EVEREST CORE	80-037	613	SCH
	1	EA	SURFACE CLOSER	4050A EDA	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	WALL STOP	WS406/407CCV	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER

3

## 4 Hardware Group No. 07

5	3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
	1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
	1	EA	SFIC EVEREST CORE	80-037	613	SCH
	1	EA	SURFACE CLOSER	4050A CUSH	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER

6

## 7 Hardware Group No. 08

8	3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
	1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
	1	EA	SFIC EVEREST CORE	80-037	613	SCH
	1	EA	OH STOP	100S	652	GLY
	1	EA	SURFACE CLOSER	4050A RW/PA ST-5003	689	LCN
	1	EA	MOUNTING PLATE	4050A-18 SRT	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER

9

## 1 Hardware Group No. 09

2	1	EA	CONT. HINGE	224HD EPT		628	IVE
	1	EA	POWER TRANSFER	EPT10	⚡	689	VON
	1	EA	ELEC FIRE EXIT HARDWARE	FSA-F-25-R-L-DANE 24 VDC	⚡	626	FAL
	1	EA	SFIC EVEREST CORE	80-037		613	SCH
	1	EA	SFIC MORTISE CYL.	80-132		626	SCH
	1	EA	SURFACE CLOSER	4050A SCUSH		689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
	1	EA	GASKETING	488SBK PSA		BK	ZER
	1	EA	POWER SUPPLY	PS902 BBK 900-2RS 120/240 VAC	⚡	LGR	SCE
	1			CARD READER - WORK OF DIVISION 28			
	1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS			
	1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS			

3

## 4 Hardware Group No. 10

5	6	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
	2	EA	POWER TRANSFER	EPT10	⚡	689	VON
	1	EA	CONST LATCHING BOLT	FB51T		630	IVE
	1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
	1	EA	SFIC EVEREST CORE	80-037		613	SCH
	1	EA	ELECTRIC STRIKE	6223 FSE DS 12/16/24/28 VAC/VDC	⚡	630	VON
	1	EA	COORDINATOR	COR X FL		628	IVE
	2	EA	MOUNTING BRACKET	MB AS REQUIRED		BLK	IVE
	2	EA	SURFACE CLOSER	4050A SCUSH		689	LCN
	2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
	2	EA	SILENCER	SR64		GRY	IVE
	1			CARD READER - WORK OF DIVISION 28			
	1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS			
	1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS			

6

## 1 Hardware Group No. 11

2	EA	CONT. HINGE	224HD EPT		628	IVE
2	EA	POWER TRANSFER	EPT10	⚡	689	VON
2	EA	ELEC FIRE EXIT HARDWARE	FSA-F-25-V-L-LBR-DANE 24 VDC	⚡	626	FAL
2	EA	SFIC EVEREST CORE	80-037		613	SCH
2	EA	SFIC MORTISE CYL.	80-132		626	SCH
2	EA	SURFACE CLOSER	4050A EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	WALL STOP	WS406/407CCV		630	IVE
2	EA	MAGNET	SEM7850 12V/24V/120V	⚡	689	LCN
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	POWER SUPPLY	PS902 BBK 900-2RS 120/240 VAC	⚡	LGR	SCE
1			CARD READER - WORK OF DIVISION 28			
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS			
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS			

3

## 4 Hardware Group No. 12

3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037		613	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1			CARD READER - WORK OF DIVISION 28			
1			DOOR CONTACT(S) - WORK OF DIVISION 28			
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS			
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS			
1	EA		REQUEST TO EXIT - WORK OF DIVISION 28	⚡		

6



## 1 Hardware Group No. 13

2

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	613	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4050A RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1			CARD READER - WORK OF DIVISION 28		
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

3

## 4 Hardware Group No. 14

5

1	EA	CONT. HINGE	224HD	628	IVE
1	EA	PANIC HARDWARE	CD-25-R-L-NL-DANE	626	FAL
2	EA	SFIC EVEREST CORE	80-037	613	SCH
2	EA	SFIC MORTISE CYL.	80-132	626	SCH
1	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4050A EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1			CARD READER - WORK OF DIVISION 28		
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

6

## 7 Hardware Group No. 15

8

1	EA	HARDWARE BY DOOR MANUFACTURER
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9

## 1 Hardware Group No. 16

2	1	EA	CONT. HINGE	112HD EPT		628	IVE
	1	EA	POWER TRANSFER	EPT10	⚡	689	VON
	1	EA	ELEC PANIC HARDWARE	CD-RX-24-R-NL-OP	⚡	626	FAL
	2	EA	SFIC EVEREST CORE	80-037		613	SCH
	1	EA	SFIC MORTISE CYL.	80-132		626	SCH
	1	EA	SFIC RIM CYLINDER	80-159		626	SCH
	1	EA	OH STOP	100S		630	GLY
	1	EA	SURFACE CLOSER	4050A EDA		689	LCN
	1	EA	PA MOUNTING PLATE	4050A-18PA SRT		689	LCN
	1	EA	DOOR SWEEP	39A		A	ZER
	1	EA	THRESHOLD	655A		A	ZER
	1	EA	DOOR CONTACT	679-05HM	⚡	BLK	SCE
	1			CARD READER - WORK OF DIVISION 28			
	1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS			
	1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS			

3

## 4 Hardware Group No. 17

5	1	EA	CONT. HINGE	112HD EPT		628	IVE
	1	EA	POWER TRANSFER	EPT10	⚡	689	VON
	1	EA	EU MORTISE LOCK	L9095HDEU 06A CON 12/24 VDC	⚡	626	SCH
	2	EA	SFIC EVEREST CORE	80-037		613	SCH
	1	EA	OH STOP	100S		630	GLY
	1	EA	SURFACE CLOSER	4050A EDA		689	LCN
	1	EA	PA MOUNTING PLATE	4050A-18PA SRT		689	LCN
	1	EA	DOOR SWEEP	39A		A	ZER
	1	EA	THRESHOLD	655A		A	ZER
	1	EA	DOOR CONTACT	679-05HM	⚡	BLK	SCE
	1	EA	POWER SUPPLY	PS902 BBK 900-2RS 120/240 VAC	⚡	LGR	SCE
	1			CARD READER - WORK OF DIVISION 28			
	1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS			
	1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS			

6

## 1 Hardware Group No. 18

2

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	613	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4050A CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1			CARD READER - WORK OF DIVISION 28		
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

3

## 4 Hardware Group No. 19

5

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	613	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	630	VON
1	EA	OH STOP	100S	652	GLY
1	EA	SURFACE CLOSER	4050A RW/PA ST-5003	689	LCN
1	EA	MOUNTING PLATE	4050A-18 SRT	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1			CARD READER - WORK OF DIVISION 28		
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

6

## 1 Hardware Group No. 20

2

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	613	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4050A RW/PA	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1			CARD READER - WORK OF DIVISION 28		
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

3

## 4 Hardware Group No. 21

5

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80HD RHO	626	SCH
1	EA	SFIC EVEREST CORE	80-037	613	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	630	VON
1	EA	SURFACE CLOSER	4050A EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1			CARD READER - WORK OF DIVISION 28		
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

6

## 1 Hardware Group No. 22

2	3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
	1	EA	INSTITUTION LOCK	ND82HD RHO	626	SCH
	2	EA	SFIC EVEREST CORE	80-037	613	SCH
	1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	630	VON
	1	EA	SURFACE CLOSER	4050A RW/PA	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	WALL STOP	WS406/407CCV	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER
	1	EA	DOOR CONTACT	679-05HM	BLK	SCE
	2			CARD READER - WORK OF DIVISION 28		
	1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
	1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

## 3

## 4 Hardware Group No. 23

5	3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
	1	EA	INSTITUTION LOCK	ND82HD RHO	626	SCH
	2	EA	SFIC EVEREST CORE	80-037	613	SCH
	1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	630	VON
	1	EA	OH STOP	100S	652	GLY
	1	EA	SURFACE CLOSER	4050A RW/PA ST-5003	689	LCN
	1	EA	MOUNTING PLATE	4050A-18 SRT	689	LCN
	1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
	1	EA	GASKETING	488SBK PSA	BK	ZER
	1	EA	DOOR CONTACT	679-05HM	BLK	SCE
	2			CARD READER - WORK OF DIVISION 28		
	1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
	1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

## 6

## 7 Hardware Group No. 24

8	2	EA	CONT. HINGE	112HD	628	IVE
	2	EA	DUMMY PUSH BAR	250DT	626	FAL
	2	EA	90 DEG OFFSET PULL	8190EZHD 12" STD	630- 316	IVE
	2	EA	OH STOP	100S	652	GLY
	2	EA	SURFACE CLOSER	4050A EDA	689	LCN
	2	EA	PA MOUNTING PLATE	4050A-18PA SRT	689	LCN
	2	EA	DOOR SWEEP	39A	A	ZER

## 9

## 1 Hardware Group No. 25

2	1	EA	CONT. HINGE	112HD	628	IVE
	1	EA	DUMMY PUSH BAR	250DT	626	FAL
	1	EA	90 DEG OFFSET PULL	8190EZHD 12" STD	630-316	IVE
	1	EA	OH STOP	100S	652	GLY
	1	EA	SURFACE CLOSER	4050A EDA	689	LCN
	1	EA	PA MOUNTING PLATE	4050A-18PA SRT	689	LCN
	1	EA	DOOR SWEEP	39A	A	ZER

3

## 4 Hardware Group No. 26

5	1	EA	CONT. HINGE	112HD EPT	628	IVE
	1	EA	POWER TRANSFER	EPT10	689	VON
	1	EA	ELEC PANIC HARDWARE	RX-MEL-24-R-NL-OP 24 VDC	626	FAL
	1	EA	SFIC EVEREST CORE	80-037	613	SCH
	1	EA	SFIC RIM CYLINDER	80-159	626	SCH
	1	EA	90 DEG OFFSET PULL	8190EZHD 12" STD	630-316	IVE
	1	EA	OH STOP	100S	652	GLY
	1	EA	SURFACE CLOSER	4050A EDA	689	LCN
	1	EA	PA MOUNTING PLATE	4050A-18PA SRT	689	LCN
	1	EA	DOOR SWEEP	39A	A	ZER
	1	EA	THRESHOLD	655A	A	ZER
	1	EA	DOOR CONTACT	679-05HM	BLK	SCE
	1	EA	POWER SUPPLY	PS902 BBK 900-2RS 120/240 VAC	LGR	SCE
	1		CARD READER - WORK OF DIVISION 28			
	1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS		
	1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS		

6

## 1 Hardware Group No. 27

2	EA	CONT. HINGE	112HD EPT		628	IVE
2	EA	POWER TRANSFER	EPT10	↗	689	VON
1	EA	REMOVABLE MULLION	KR4023 STAB		SP28	FAL
1	EA	ELEC PANIC HARDWARE	RX-MEL-24-R-EO 24 VDC	↗	626	FAL
1	EA	ELEC PANIC HARDWARE	RX-MEL-24-R-NL-OP 24 VDC	↗	626	FAL
2	EA	SFIC EVEREST CORE	80-037		613	SCH
1	EA	SFIC MORTISE CYL.	80-132		626	SCH
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 12" STD		630-316	IVE
2	EA	OH STOP	100S		652	GLY
2	EA	SURFACE CLOSER	4050A EDA		689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA SRT		689	LCN
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A		A	ZER
1	EA	DOOR CONTACT	679-05HM	↗	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS 120/240 VAC	↗	LGR	SCE
1			CARD READER - WORK OF DIVISION 28			
1	EA	NOTE	PROVIDE POINT TO POINT WIRING DIAGRAMS			
1	EA	NOTE	PROVIDE RISER WIRING DIAGRAMS			

3

## 4 Hardware Group No. 28

1	EA	CONT. HINGE	224HD		628	IVE
1	EA	STOREROOM LOCK	ND80HD RHO		626	SCH
1	EA	SFIC EVEREST CORE	80-037		613	SCH
1	EA	SURFACE CLOSER	4050A SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		630	IVE
1	EA	GASKETING	328AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A		A	ZER

6

## 7 Hardware Group No. 29

1	EA	POWER SUPPLY	Power Supply w/ BATTERY BACK-UP and RELAY BOARDS AS REQUIRED	↗		DET
1	EA	EXIT DEVICE	10XW-03C-626- ER EX W GTPLKIT	↗	626	DET
1	EA	SFIC EVEREST CORE	80-037		613	SCH
1	EA	SFIC RIM CYLINDER	80-159		626	SCH
1			BALANCE OF HARDWARE BY GATE MANUFACTURER			

9

1    END OF SECTION



1 SECTION 088000 - GLAZING

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Glass for doors, interior glazed openings, and storefront framing.  
6 2. Glazing sealants and accessories.

7 B. Related Requirements:

- 8 1. Section 088813 "Fire-Rated Glazing."  
9 2. Section 088853 "Security Glazing."

10 1.2 DEFINITIONS

- 11 A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in  
12 referenced glazing publications.
- 13 B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- 14 C. IBC: International Building Code.
- 15 D. Interspace: Space between lites of an insulating-glass unit.

16 1.3 COORDINATION

- 17 A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face  
18 clearances, and adequate sealant thicknesses, with reasonable tolerances.

19 1.4 ACTION SUBMITTALS

- 20 A. Product Data: For each type of product.
- 21 B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300  
22 mm) square.
- 23 C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths. Install  
24 sealant Samples between two strips of material representative in color of the adjoining framing system.
- 25 D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same  
26 designations indicated on Drawings.
- 27 E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design  
28 criteria, including analysis data signed and sealed by the qualified professional engineer responsible for  
29 their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer glass testing agency and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating glass and, for tests performed by a qualified testing agency.
  - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
  - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
  - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
  - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
  - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
  - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
  - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

## 1.10 WARRANTY

- A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
  - 1. Berkowitz, JE, LP.
  - 2. Cardinal Glass Industries.
  - 3. Guardian Industries Corp.
  - 4. Oldcastle BuildingEnvelope.
  - 5. Pilkington North America Inc.
  - 6. Saint-Gobain Corporation.
  - 7. Viracon, Inc.
  - 8. Vitra Architectural Glass.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

## 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
  2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
  3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Glazing Manual."
  2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent flat glass), Quality-Q3, and complying with other requirements specified.
1. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048.
- E. One-way Vision Glass: Heat-treated float glass: ASTM C 1048, Condition C (other coated glass), Type I (transparent flat glass), Quality-Q3, Kind FT, with manufacturer's standard reflective coating, 6mm thick.

## 2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## 2.6 GLAZING SEALANTS

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

## 2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as

recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

- a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

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

## 3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

## 3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- 1 G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing  
2 channel, as recommended in writing by glass manufacturer and according to requirements in referenced  
3 glazing publications.
- 4 H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- 5 I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- 6 J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on  
7 opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to  
8 movement.
- 9 K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket  
10 manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant  
11 recommended by gasket manufacturer.

#### 12 3.4 TAPE GLAZING

- 13 A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or  
14 protrude slightly above sightline of stops.
- 15 B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make  
16 them fit opening.
- 17 C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal  
18 framing joints by applying tapes to jambs, then to heads and sills.
- 19 D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints  
20 in tapes with compatible sealant approved by tape manufacturer.
- 21 E. Do not remove release paper from tape until right before each glazing unit is installed.
- 22 F. Apply heel bead of elastomeric sealant unless otherwise indicated.
- 23 G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense  
24 compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket  
25 applications at corners and work toward centers of openings.
- 26 H. Apply cap bead of elastomeric sealant over exposed edge of tape unless otherwise indicated.

#### 27 3.5 GASKET GLAZING (DRY)

- 28 A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with  
29 allowance for stretch during installation.
- 30 B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints  
31 miter cut and bonded together at corners.
- 32 C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press  
33 firmly against soft compression gasket by inserting dense compression gaskets formed and installed to  
34 lock in place against faces of removable stops. Start gasket applications at corners and work toward  
35 centers of openings. Compress gaskets to produce a weathertight seal without developing bending  
36 stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.



D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

### 3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.7 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.8 GLASS SCHEDULE

A. Glass Type MG-1: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

B. Glass Type MG-2: Fire-rated safety glass .

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

C. Glass Type IGU-1: Low-E-coated, clear insulating glass.

1. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70.
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Annealed float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Annealed float glass.
7. Low-E Coating: Manufacturer's proprietary magnetic sputter vacuum deposition (MSVD) low-e coating on second surface.
8. Visible Light Transmittance: 64 percent.
9. Winter Nighttime U-Factor: 0.28 maximum.
10. Solar Heat Gain Coefficient: 0.27 maximum.
11. Indoor Visible Reflectance: 14 percent.
12. Outdoor Visible Reflectance: 13 percent.

D. Glass Type IGU-2: Low-E-coated, clear insulating glass.

1. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70.
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Manufacturer's proprietary magnetic sputter vacuum deposition (MSVD) low-e coating on second surface.
8. Visible Light Transmittance: 64 percent.
9. Winter Nighttime U-Factor: 0.28 maximum.
10. Solar Heat Gain Coefficient: 0.27 maximum.
11. Indoor Visible Reflectance: 14 percent.
12. Outdoor Visible Reflectance: 13 percent.
13. Safety glazing required.

E. Glass Type IGU-3: Ceramic-coated spandrel insulating glass.

1. Basis-of-Design Product: PPG Industries, Inc.; Solarban 70.
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Indoor Lite: Ceramic-coated spandrel glass.
  - a. Kind HS (heat-strengthened)
  - b. Ceramic Coating Location: Fourth Surface.
  - c. Color: As selected by Architect from manufacturer's full range
7. Low-E Coating: Manufacturer's proprietary magnetic sputter vacuum deposition (MSVD) low-e coating on second surface.

F. Glass Type IGU-4: One-Way clear insulating glass.

1. Outdoor Lite: Pilkington Mirropane (Basis-of-Design Product)
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Interspace Content: Air.
5. Interior Lite: Fully tempered float glass.

END OF SECTION 088000

1 SECTION 088813 - FIRE-RATED GLAZING

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Fire-protection-rated glazing.

6 1.2 COORDINATION

- 7 A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face  
8 clearances, and adequate sealant thicknesses, with reasonable tolerances.

9 1.3 ACTION SUBMITTALS

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

11 1.4 INFORMATIONAL SUBMITTALS

- 12 A. Product Certificates: For each type of glass and glazing product.

- 13 B. Sample warranties.

14 1.5 QUALITY ASSURANCE

- 15 A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are  
16 certified under the NGA's Certified Glass Installer Program.

17 1.6 WARRANTY

- 18 A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass  
19 units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as  
20 defects developed from normal use that are not attributed to glass breakage or to maintaining and  
21 cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation,  
22 delamination materially obstructing vision through glass, and blemishes exceeding those allowed by  
23 referenced laminated-glass standard.

- 24 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

## 2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

- B. Ultraclear Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.

- C. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- D. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.  
2. Interlayer Thickness: Provide thickness as needed to comply with requirements.  
3. Interlayer Color: Clear unless otherwise indicated.

## 2.3 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.

1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from hose-stream test.

- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F (250 deg C) temperature-rise limitation; and fire-resistance rating in minutes.

C. Fire-Protection-Rated Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 5-mm thickness; faced on one surface with a clear glazing film; complying with 16 CFR 1201, Category II.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Technical Glass Products, Firelite NT or comparable product from one of the following:

- a. SAFTI FIRST Fire Rated Glazing Solutions
- b. Vetrotech Saint-Gobain

#### 2.4 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

### PART 3 - EXECUTION

#### 3.1 GLAZING, GENERAL

A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.

B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

#### 3.2 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent

- 1 intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits,  
2 or stains.
- 3 1. If, despite such protection, contaminating substances do contact with glass, remove substances  
4 immediately as recommended in writing by glass manufacturer.
- 5 C. Remove and replace glass that is damaged during construction period.
- 6 3.3 FIRE-PROTECTION-RATED GLAZING SCHEDULE
- 7 A. Glass Type MG-2: 60-minute fire-protection-rated glazing with 450 deg F temperature-rise limitation in  
8 rated doors only, with a maximum vision area of 100 sq. in..
- 9 END OF SECTION 088813

1 SECTION 092216 - NON-STRUCTURAL METAL FRAMING

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Non-load-bearing steel framing systems for interior partitions.  
6 2. Suspension systems for interior ceilings and soffits.

7 B. Related Requirements:

- 8 1. Section 054000 "Cold-Formed Metal Framing" for exterior wall studs and load-bearing framing  
9 applications.

10 1.2 ACTION SUBMITTALS

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

- 12 1. Studs and Runners: Provide documentation that framing members' certification is according to  
13 SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-  
14 Structural Framing Members."

15 1.3 INFORMATIONAL SUBMITTALS

- 16 A. Evaluation Reports: For embossed steel studs and runners and firestop tracks, from ICC-ES or other  
17 qualified testing agency acceptable to authorities having jurisdiction.

18 PART 2 - PRODUCTS

19 2.1 PERFORMANCE REQUIREMENTS

- 20 A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-  
21 bearing steel framing, provide materials and construction identical to those tested in assembly indicated,  
22 according to ASTM E 119 by an independent testing agency.

- 23 B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those  
24 tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an  
25 independent testing agency.

26 2.2 FRAMING SYSTEMS

- 27 A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

- 28 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise  
29 indicated.

2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.

1. Steel Studs and Runners:

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

- 1) CEMCO; California Expanded Metal Products Co.
- 2) MBA Building Supplies.
- 3) MRI Steel Framing, LLC.
- 4) Phillips Manufacturing Co.
- 5) Steel Network, Inc. (The).
- 6) Telling Industries.

b. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm), 25 gauge.

c. Depth: 3-5/8 inches (92 mm), unless otherwise indicated.

2. Embossed Steel Studs and Runners:

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

- 1) CEMCO; California Expanded Metal Products Co.
- 2) ClarkDietrich Building Systems.
- 3) Marino\WARE.
- 4) MBA Building Supplies.
- 5) Phillips Manufacturing Co.
- 6) Steel Network, Inc. (The).
- 7) Telling Industries.

b. Minimum Base-Metal Thickness: 0.0190 inch (0.483 mm).

c. Depth: 3-5/8 inches (92 mm), unless otherwise indicated.

C. Slip-Type Head Joints: For top-track interface (head joint), provide the following:

1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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

- 1) BlazeFrame Industries.
- 2) CEMCO; California Expanded Metal Products Co.
- 3) ClarkDietrich Building Systems.
- 4) MBA Building Supplies.
- 5) Metal-Lite; The System.
- 6) Steel Network, Inc. (The).
- 7) Telling Industries.



D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

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

- a. BlazeFrame Industries.
- b. CEMCO; California Expanded Metal Products Co.
- c. Fire Trak Corp.
- d. Metal-Lite; The System.
- e. Steel Network, Inc. (The).

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0296 inch (0.752 mm).

F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm) unless otherwise indicated.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0296 inch (0.752 mm) unless otherwise indicated.
2. Depth: As indicated on Drawings.

H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

I. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 3/4 inch (19 mm) unless otherwise indicated.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

## 2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 2-1/2 inches (64 mm), unless otherwise indicated.
- E. Furring Channels (Furring Members):
  1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
  2. Steel Studs and Runners: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0296 inch (0.752), 20 gauge.
    - b. Depth: 3-5/8 inches (92 mm), unless otherwise indicated.
  3. Embossed Steel Studs and Runners: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0190 inch (0.483 mm).
    - b. Depth: 3-5/8 inches (92 mm), unless otherwise indicated.
  4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
    - a. Minimum Base-Metal Thickness: 0.0296 inch (0.752 mm) unless otherwise indicated.
  5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical or hat shaped.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
  2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.3 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
  - a. Install two studs at each jamb unless otherwise indicated.
  - b. If control joints are indicated or required at heads of doors, install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
  - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
  - a. Firestop Track: Install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

## 3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 5. Do not attach hangers to steel roof deck.
  - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

1 SECTION 092900 - GYPSUM BOARD

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Interior gypsum board.
- 6 2. Tile backing panels.
- 7 3. Trim accessories.

8 B. Related Requirements:

- 9 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
- 10 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension
- 11 systems that support gypsum board panels.

12 1.2 ACTION SUBMITTALS

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

14 B. Samples: For trim accessories, full-size Sample in 12-inch- (300-mm-) long length for each trim

15 accessory indicated.

16 1.3 QUALITY ASSURANCE

17 A. Mockups: Before beginning gypsum board installation, build mockups of at least 100 sq. ft. (9 sq. m) in

18 surface area at locations as directed by Architect, to demonstrate aesthetic effects and to set quality

19 standards for materials and execution.

- 20 1. Build mockups for each level of gypsum board finish indicated for use in exposed locations.
- 21 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed
- 22 surfaces for review of mockups.
- 23 3. Simulate finished lighting conditions for review of mockups.
- 24 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial
- 25 Completion.

26 1.4 DELIVERY, STORAGE AND HANDLING

27 A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct

28 sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on

29 risers on a flat platform to prevent sagging.

30 1.5 FIELD CONDITIONS

31 A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's

32 written instructions, whichever are more stringent.

- 1 B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- 2 C. Do not install panels that are wet, moisture damaged, and mold damaged.
- 3 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration,  
4 sagging, or irregular shape.
- 5 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface  
6 contamination and discoloration.

## 7 PART 2 - PRODUCTS

### 8 2.1 PERFORMANCE REQUIREMENTS

- 9 A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and  
10 construction identical to those tested in assembly indicated according to ASTM E 119 by an independent  
11 testing agency.
- 12 B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those  
13 tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an  
14 independent testing agency.

### 15 2.2 GYPSUM BOARD, GENERAL

- 16 A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that  
17 correspond with support system indicated.

### 18 2.3 INTERIOR GYPSUM BOARD

- 19 A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
- 20 1. Manufacturers: Subject to compliance with requirements, provide products by one of the  
21 following:
- 22 a. American Gypsum.  
23 b. CertainTeed Corporation.  
24 c. Continental Building Products, LLC.  
25 d. Georgia-Pacific Building Products.  
26 e. National Gypsum Company.  
27 f. USG.
- 28 2. Thickness: 5/8 inch (15.9 mm).  
29 3. Long Edges: Tapered.
- 30 B. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive  
31 capability.
- 32 1. Manufacturers: Subject to compliance with requirements, provide products by one of the  
33 following:
- 34 a. American Gypsum.  
35 b. CertainTeed Corporation.  
36 c. Continental Building Products, LLC.

- 1 d. Georgia-Pacific Building Products.
- 2 e. National Gypsum Company.
- 3 f. United States Gypsum Company.
- 4 2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
- 5 3. Long Edges: Tapered.
- 6 C. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and
- 7 paper surfaces.
- 8 1. Products: Subject to compliance with requirements, provide one of the following:
- 9 a. American Gypsum; M-Bloc® Shaft Liner with Mold & Moisture Resistance.
- 10 b. CertainTeed Corporation; ProRoc Moisture and Mold Resistant Gypsum Board with
- 11 M2Tech.
- 12 c. National Gypsum Company; Gold Bond Brand XP Wallboard.
- 13 d. USG; SHEETROCK Brand Mold Tough or FIBEROCK Brand, Aqua Tough Interior
- 14 Panels.
- 15 2. Core: 5/8 inch (15.9 mm), Type X.
- 16 3. Long Edges: Tapered.
- 17 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- 18 2.4 TILE BACKING PANELS
- 19 A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's
- 20 standard edges.
- 21 1. Basis-of-Design Product: Subject to compliance with requirements, provide United States
- 22 Gypsum Company; DUROCK Cement Board.
- 23 2. Thickness: 5/8 inch (15.9 mm).
- 24 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- 25 2.5 TRIM ACCESSORIES
- 26 A. Interior Trim: ASTM C 1047.
- 27 1. Material: Galvanized or aluminum-coated steel sheet.
- 28 2. Shapes:
- 29 a. Cornerbead.
- 30 b. LC-Bead: J-shaped; exposed long flange receives joint compound.
- 31 c. L-Bead: L-shaped; exposed long flange receives joint compound
- 32 d. Expansion (control) joint.
- 33 B. Aluminum Trim Reveal Molding: Extruded accessories of profiles and dimensions indicated.
- 34 1. Products: Subject to compliance with requirements, provide one of the following:
- 35 a. Fry-Reglet Corporation.
- 36 b. Pittcon Industries
- 37 2. Aluminum: Alloy and temper with not less than the strength and durability properties of
- 38 ASTM B221 (ASTM B221M), Alloy 6063-T5.
- 39 3. Size: 1/2" wide by 5/8" deep.
- 40

4. Type:
  - a. Two-flange reveal where gypsum board abuts both sides of reveal in the same plane.
  - b. 'F'-reveal where drywall terminates against sill, jamb, or other finish material in the same plane.
5. Finish: Architectural 200R1 medium etch (AA-M32c10A21), clear color. Standard finish.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper.
  2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
  4. Finish Coat: For third coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
  5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels: As recommended by backing panel manufacturer.
- E. Joint Compound for Mold-Resistant Gypsum Board: As recommended by gypsum panel manufacturer for use with mold-resistant gypsum board products.

## 2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
  1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.



1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Provide sound-attenuation blankets manufactured from mineral wool where indicated.
- a. Basis-of-Design Manufacturer for Mineral-Wool Sound-Attenuation Blankets: Subject to compliance with requirements, provide products by Thermafiber, Inc.; an Owens Corning company.

E. Acoustical Joint Sealant: As specified in Section 079200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  2. Fit gypsum panels around ducts, pipes, and conduits.
  3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- 1 H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open  
2 (unsupported) edges of stud flanges first.
- 3 I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and  
4 penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of  
5 partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's  
6 written instructions for locating edge trim and closing off sound-flanking paths around or through  
7 assemblies, including sealing partitions above acoustical ceilings.
- 8 J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed  
9 after panels have been installed on one side.

### 10 3.3 APPLYING INTERIOR GYPSUM BOARD

- 11 A. Install interior gypsum board in the following locations:

- 12 1. Type X: Vertical and horizontal surfaces unless otherwise indicated.  
13 2. Mold-Resistant Type: Exposed surfaces located in moisture areas and where indicated.  
14 3. Type C: Where required for specific fire-resistance-rated assembly indicated.

- 15 B. Single-Layer Application:

- 16 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent  
17 possible and at right angles to framing unless otherwise indicated.  
18 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise  
19 indicated or required by fire-resistance-rated assembly, and minimize end joints.
- 20 a. Stagger abutting end joints not less than one framing member in alternate courses of  
21 panels.  
22 b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or  
23 required by fire-resistance-rated assembly.

- 24 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- 25 C. Multilayer Application:

- 26 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on  
27 walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing  
28 members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from  
29 parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
- 30 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically  
31 (parallel to framing) with joints of base layers located over stud or furring member and face-layer  
32 joints offset at least one stud or furring member with base-layer joints unless otherwise indicated  
33 or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
- 34 3. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and  
35 supplementary fasteners, unless otherwise indicated.
- 36 a. Where required for fire-resistance-rated assemblies, fasten base layers and face layers  
37 separately to supports with screws.

- 38 D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other  
39 than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board  
40 manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening  
41 adhesive has set.

## 3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

## 3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. LC-Bead: Use at exposed panel edges.
  - 3. L-Bead: Use where indicated.
- D. Aluminum Trim: Install in locations indicated on Drawings.

## 3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 3: Mechanical rooms, storage spaces, and closets.
  - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
  - 5. Level 5: At panel surfaces exposed at Lobby 101 and Commissioner's Meeting Room 153.
- E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

## 3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- 1 C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
- 2 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration,
- 3 sagging, or irregular shape.
- 4 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface
- 5 contamination and discoloration.
- 6 END OF SECTION 092900

1 SECTION 093013 - CERAMIC TILING

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Porcelain tile.
- 6 2. Stone thresholds.
- 7 3. Waterproofing and crack isolation membrane.
- 8 4. Metal edge strips.

9 B. Related Requirements:

- 10 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints
- 11 in tile surfaces.

12 1.2 DEFINITIONS

- 13 A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to
- 14 Work of this Section unless otherwise specified.

- 15 B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C,
- 16 ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10,
- 17 ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and
- 18 ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

- 19 C. Module Size: Actual tile size plus joint width indicated.

- 20 D. Face Size: Actual tile size, excluding spacer lugs.

21 1.3 PREINSTALLATION MEETINGS

- 22 A. Preinstallation Conference: Conduct conference at Project site.

- 23 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

24 1.4 ACTION SUBMITTALS

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

- 26 B. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

- 27 C. Samples for Verification:

- 28 1. Full-size units of each type and composition of tile and for each color and finish required.
- 29 2. Full-size units of each type of trim and accessory for each color and finish required.
- 30 3. Stone thresholds in 6-inch (150-mm) lengths.

31 1.5 INFORMATIONAL SUBMITTALS

- 32 A. Qualification Data: For Installer.

- 33 B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer
- 34 and Installer.

1 C. Product Certificates: For each type of product.

2 D. Product Test Reports: For tile-setting and -grouting products.

3 1.6 MAINTENANCE MATERIAL SUBMITTALS

4 A. Furnish extra materials that match and are from same production runs as products installed and that are  
5 packaged with protective covering for storage and identified with labels describing contents.

6 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for  
7 each type, composition, color, pattern, and size indicated.

8 1.7 QUALITY ASSURANCE

9 A. Installer Qualifications:

10 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of  
11 Excellence member of the Tile Contractors' Association of America.

12 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.

13 3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized  
14 by the U.S. Department of Labor as Journeyman Tile Layers.

15 1.8 DELIVERY, STORAGE, AND HANDLING

16 A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until  
17 time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

18 B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

19 C. Store aggregates where grading and other required characteristics can be maintained and contamination  
20 can be avoided.

21 D. Store liquid materials in unopened containers and protected from freezing.

22 1.9 FIELD CONDITIONS

23 A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient  
24 temperature and humidity conditions are maintained at the levels indicated in referenced standards and  
25 manufacturer's written instructions.

26 PART 2 - PRODUCTS

27 2.1 MANUFACTURERS

28 A. Source Limitations for Tile: Obtain tile of each type from single source or producer.

29 1. Obtain tile of each type and color or finish from same production run and of consistent quality in  
30 appearance and physical properties for each contiguous area.

31 B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each  
32 mortar, adhesive, and grout component from single manufacturer and each aggregate from single source  
33 or producer.

34 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from  
35 single manufacturer.

36 2. Obtain waterproof and crack isolation membrane from manufacturer of setting and grouting  
37 materials.

- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
1. Stone thresholds.
  2. Waterproofing and crack isolation membrane.
  3. Metal edge strips.

## 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

## 2.3 TILE PRODUCTS

- A. Ceramic Tile Type CT-1: Porcelain ceramic large-format floor tile.

Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Garden State Tile product indicated on Drawings or a comparable product by one of the following manufacturers:

1. Crossville Tile.
2. Nemo Tile.
3. Face Size: As indicated.
4. Thickness: As indicated.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Tile Color and Pattern: As indicated by manufacturer's designations.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile unless otherwise indicated. Provide shapes indicated, or if not indicated, as selected by Architect from manufacturer's standard shapes.

- B. Ceramic Tile Type CT-2: Porcelain ceramic large-format floor tile.

Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Trinity Tile product indicated on Drawings or a comparable product by one of the following manufacturers:

1. Crossville Tile.
2. Nemo Tile.
3. Face Size: As indicated.
4. Thickness: As indicated.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Tile Color and Pattern: As indicated by manufacturer's designations.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile unless otherwise indicated. Provide shapes indicated, or if not indicated, as selected by Architect from manufacturer's standard shapes.

- C. Ceramic Tile Type CT-3: Porcelain ceramic mosaic tile.

Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Trinity Tile product indicated on Drawings or a comparable product by one of the following manufacturers:

1. Crossville Tile.

2. Nemo Tile.
3. Face Size: As indicated.
4. Thickness: As indicated.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Tile Color and Pattern: As indicated by manufacturer's designations.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile unless otherwise indicated. Provide shapes indicated, or if not indicated, as selected by Architect from manufacturer's standard shapes.

D. Ceramic Tile Type CT-4: Ceramic wall tile.

Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Garden State Tile product indicated on Drawings or a comparable product by one of the following manufacturers:

1. Crossville Tile.
2. Nemo Tile.
3. Face Size: As indicated.
4. Thickness: As indicated.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Tile Color and Pattern: As indicated by manufacturer's designations.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile unless otherwise indicated. Provide shapes indicated, or if not indicated, as selected by Architect from manufacturer's standard shapes.

E. Ceramic Tile Type CT-5: Ceramic wall tile.

Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Garden State Tile product indicated on Drawings or a comparable product by one of the following manufacturers:

1. Crossville Tile.
2. Nemo Tile.
3. Face Size: As indicated.
4. Thickness: As indicated.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Tile Color and Pattern: As indicated by manufacturer's designations.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile unless otherwise indicated. Provide shapes indicated, or if not indicated, as selected by Architect from manufacturer's standard shapes.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes; full width of jamb unless otherwise indicated.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Granite Thresholds: ASTM C 615/C 615M, with honed finish.

2.5 WATERPROOFING AND CRACK ISOLATION MEMBRANE

A. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete International, Inc.; Laticrete Hydro Ban.



## 2.6 SETTING MATERIALS

## A. Modified Cement Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Custom Building Products.
  - b. Laticrete International, Inc.
  - c. MAPEI Corporation.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

## B. Medium-Bed, Modified Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Custom Building Products.
  - b. Laticrete International, Inc.
  - c. MAPEI Corporation.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

## 2.7 GROUT MATERIALS

## A. Unsanded Cement Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Custom Building Products.
  - b. Laticrete International, Inc.
  - c. MAPEI Corporation.

## B. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Custom Building Products.
  - b. Laticrete International, Inc.
  - c. MAPEI Corporation.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.

## C. Grout Colors: As indicated by manufacturer's designations.

## 2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Aluminum strips, height to match tile and setting-bed thickness, designed specifically for tile applications indicated; of profiles indicated and to suit conditions, with integral provision for anchorage to substrate and as follows:
  - 1. Basis-of-Design Products: Provide the following products by Schluter Systems L.P. (schluter.com) for the conditions indicated:
    - a. Base Cove: Schluter®-DILEX-AHK; installed at room perimeter conditions at bottom of wall base.
    - b. Finish Trim: Schluter®-SCHIENE; installed at flooring material transitions from ceramic porcelain tile to resilient floor.
    - c. Finish Trim: Schluter®-JOLLY; installed at wall corner transitions ar ceramic porcelain tile to ceramic porcelain tile.
  - 2. Finish: Brushed chrome anodized aluminum.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

## 2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

- D. Temporary Protective Coating: If needed to prevent mortar or grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating recommended by tile manufacturer, taking care not to coat unexposed tile surfaces.

### 3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For tile floors, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage.

- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

- G. Joint Widths: Unless otherwise indicated, install tile with joint widths recommended by tile manufacturer and approved by Architect.

- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
1. Do not extend waterproofing and crack isolation membrane under thresholds set in modified dry-set cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing and crack isolation membrane with elastomeric sealant.

### 3.4 WATERPROOFING AND CRACK ISOLATION INSTALLATION

- A. Install waterproofing and crack isolation membrane to comply with ANSI A108.13, ANSI A108.17, and manufacturer's written instructions to produce waterproof and crack isolation membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing and crack isolation membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove grout residue from tile as soon as possible.
  2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### 3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
1. Ceramic Tile Installation: TCNA F122 and F125A; thinset mortar on waterproofing and crack isolation membrane.
  - a. Thinset Mortar: Medium-bed, modified dry-set cement mortar.

- 1                   b.     Grout:
- 2                   1)     Unsanded Cement Grout
- 3                   2)     Locker Rooms and Bathrooms: Water-cleanable epoxy grout.
- 4
- 5        B.     Interior Wall Base Installations, Studs or Furring:
- 6           1.     Ceramic Tile Installation: TCNA W243; thinset mortar on gypsum board.
- 7                   a.     Thinset Mortar: Modified dry-set cement mortar.
- 8                   b.     Grout: Water-cleanable epoxy grout.
- 9    END OF SECTION 093013

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes: Acoustical panels and exposed suspension systems for interior ceilings.
- B. Related Requirements:
  - 1. Section 092216 "Non-Structural Metal Framing" for suspension systems for interior ceilings and soffits.
- C. Section 092900 "Gypsum Board" for gypsum wall board used at transition moldings

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For components with factory-applied finishes.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
  - 1. Acoustical Panels: Set of 6-inch (150-mm) square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch (150-mm) long Samples of each type, finish, and color.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Ceiling suspension-system members.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
  - 5. Size and location of initial access modules for acoustical panels.
  - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
    - a. Lighting fixtures.
    - b. Diffusers.
    - c. Grilles.
    - d. Speakers.
    - e. Sprinklers.
    - f. Access panels.
    - g. Perimeter moldings.
  - 7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.

8. Minimum Drawing Scale: 1/8 inch = 1 foot.

B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

#### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

#### 1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

1. Obtain suspension system from same manufacturer as acoustical ceiling panels if ceiling units specified will fit only the same manufacturer's suspension system.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

## 2.3 ACOUSTICAL PANELS FOR APC-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by Armstrong World Industries, Inc. or comparable product by one of the following:

1. CertainTeed Corporation.
2. United States Gypsum Company.

- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

- C. Classification: Provide panels as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: CE (perforated, small holes and lightly textured).

- D. Panel Characteristics:

1. Color: White.
2. Light Reflectance (LR): Not less than 0.80.
3. Ceiling Attenuation Class (CAC): Not less than 35.
4. Noise Reduction Coefficient (NRC): Not less than 0.65.
5. Edge/Joint Detail: Beveled tegular reveal sized to fit flange of exposed suspension-system members.
6. Thickness: 5/8 inch (15 mm).
7. Modular Size: 24 by 48 (610 mm by 1220 mm).

## 2.4 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings by Armstrong World Industries, Inc. or comparable products by one of the following:

1. CertainTeed Corporation.
2. Chicago Metallic Corporation.
3. United States Gypsum Company.

- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.



1. High-Humidity Finish: Provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch (24-mm) wide metal caps on flanges.
  1. Structural Classification: Intermediate-duty system.
  2. End Condition of Cross Runners: Butt-edge type.
  3. Face Design: Flat, flush.
  4. Cap Material: Cold-rolled steel or aluminum.
  5. Cap Finish: Painted white.
- 2.5 ACCESSORIES
  - A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
  - B. Wire Hangers, Braces, and Ties: Provide wires as follows:
    1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper unless otherwise indicated.
    2. Wire Material for Moisture Areas: Provide one of the following for acoustical panel ceilings located in toilet rooms, locker rooms, shower areas, kitchens and food service areas:
      - a. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
      - b. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
    3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch (2.69-mm) diameter wire.
  - C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
  - D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
  - E. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch (1-mm) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch (8-mm) diameter bolts.
  - F. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
  - G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
  - H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

## 2.6 METAL EDGE MOLDINGS AND TRIM

- A. Extruded Aluminum Trim: Manufacturer's standard extruded aluminum trim, see drawings for locations and size and configuration.
- B. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

## 2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

## 3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices

- that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Rubber base.
2. Rubber molding accessories.

## 1.2 ACTION SUBMITTALS

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

## B. Samples for Initial Selection: For each type of product indicated.

## C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

## D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

## 1.3 MAINTENANCE MATERIAL SUBMITTALS

## A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## 1.4 DELIVERY, STORAGE, AND HANDLING

## A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

## 1.5 FIELD CONDITIONS

## A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

## B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

## C. Install resilient products after other finishing operations, including painting, have been completed.

## 1 PART 2 - PRODUCTS

## 2 2.1 RUBBER BASE indicated as B-1 in drawings.

3 A. Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett  
4 product indicated on Drawings or a comparable product by one of the following manufacturers:

- 5 1. Armstrong World Industries, Inc.  
6 2. Roppe Corporation, USA.

7 B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset) or Type TP (rubber,  
8 thermoplastic), Group I (solid, homogeneous).

- 9 1. Millwork profile, provide in areas with CT-1

10 C. Thickness: 0.25 inch (6.35 mm).

11 D. Height: 6 inches (15.24 mm).

12 E. Lengths: 8' lengths.

13 F. Outside Corners: Preformed.

14 G. Inside Corners: Job formed or preformed.

15 H. Colors: As indicated by manufacturer's designations.

## 16 2.2 RUBBER BASE indicated as B-2 in drawings.

17 A. Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Tarkett  
18 product indicated on Drawings or a comparable product by one of the following manufacturers:

- 19 1. Armstrong World Industries, Inc.  
20 2. Roppe Corporation, USA.

21 B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset) or Type TP (rubber,  
22 thermoplastic), Group I (solid, homogeneous).

- 23 1. Cove style.

24 C. Thickness: 0.125 inch (3.17 mm).

25 D. Height: 4 inches (10.16cm mm).

26 E. Lengths: Coils in manufacturer's standard length.

27 F. Outside Corners: Preformed.

28 G. Inside Corners: Job formed or preformed.

29 H. Colors: As indicated by manufacturer's designations.

## 30 2.3 RUBBER STAIR ACCESSORIES – indicated as ST-1 in drawings

31 A. Fire-Test-Response Characteristics: As determined by testing identical products according to  
32 ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite product by Tarkett, indicated on Drawings or a comparable product by one of the following manufacturers:

1. Nora Flooring.
2. Roppe Corporation, USA.

C. Stair Treads: ASTM F2169.

1. Type: TS (rubber, vulcanized thermoset).
2. Class: 2 (pattern; embossed, grooved, or ribbed).
3. Group: 2 (with contrasting color/texture for the visually impaired).
4. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
5. Nosing Height: 1-3/4 inches (45 mm).
6. Thickness: 1/4 inch (6 mm) and tapered to back edge.
7. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
8. Integral Risers: Smooth, flat; in height that fully covers substrate.

D. Landing Tile: Matching treads, as indicated in drawings; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

E. Locations: Provide rubber stair accessories in areas indicated.

2.4 Colors and Patterns: As indicated by manufacturer's designations

#### 2.5 RUBBER MOLDING ACCESSORY

A. Description: Rubber carpet edge for glue-down applications, reducer strip for resilient flooring, joiner for tile and carpet, and transition strips.

B. Colors and Patterns: As selected by Architect from full range of industry options.

#### 2.6 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.

4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

- 1 F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with  
2 manufacturer's recommended adhesive filler material.
- 3 G. Preformed Corners: Install preformed corners before installing straight pieces.
- 4 H. Job-Formed Corners:
- 5 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less  
6 than 6 inches (150 mm) in length.
- 7 a. Form without producing discoloration (whitening) at bends.
- 8 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less  
9 than 6 inches (150 mm) in length.
- 10 a. Miter or cope corners to minimize open joints.

11 3.4 RESILIENT ACCESSORY INSTALLATION

- 12 A. Comply with manufacturer's written instructions for installing resilient accessories.
- 13 B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout  
14 length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

15 3.5 CLEANING AND PROTECTION

- 16 A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- 17 B. Perform the following operations immediately after completing resilient-product installation:
- 18 1. Remove adhesive and other blemishes from surfaces.
- 19 C. Protect resilient products from mars, marks, indentations, and other damage from construction operations  
20 and placement of equipment and fixtures during remainder of construction period.
- 21 D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

22 END OF SECTION 096513



1 SECTION 096519 - RESILIENT TILE FLOORING

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

- 5 1. Luxury Vinyl floor tile  
6 2. Vinyl composition floor tile (VCT).

7 B. Related Requirements:

- 8 1. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other  
9 accessories installed with resilient floor coverings.

10 1.2 ACTION SUBMITTALS

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

12 B. Shop Drawings: For each type of resilient floor tile.

- 13 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture,  
14 cabinets, and cutouts.  
15 2. Show details of special patterns.

16 C. Samples for Initial Selection: For each type of floor tile indicated.

17 D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

18 E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

19 1.3 CLOSEOUT SUBMITTALS

20 A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

21 1.4 MAINTENANCE MATERIAL SUBMITTALS

22 A. Furnish extra materials, from the same product run, that match products installed and that are packaged  
23 with protective covering for storage and identified with labels describing contents.

- 24 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern  
25 of floor tile installed.

26 1.5 DELIVERY, STORAGE, AND HANDLING

27 A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient  
28 temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10  
29 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

## 1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following periods:
1. 48 hours before installation.
  2. During installation.
  3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

## 2.1 LUXURY VINYL FLOOR TILE indicated as LVT-1 in drawings

- A. Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide Interface product indicated on Drawings or a comparable product by one of the following manufacturers:
1. Shaw Contract Group.
  2. Tarkett.
- B. Tile Standard: ASTM F 1700. Class III printed film vinyl tile Type B (embossed)
- C. Size: As indicated on Drawings.
- D. Wear-layer Thickness: 20 mil
- E. Overall Thickness: 0.196850393700787 in (5 mm).
- F. Finish: Ceramor or equal
- G. Colors and Patterns: As indicated by manufacturer's designations on Drawings.
- H. Installation: Glue Down.

## 2.2 VINYL COMPOSITION FLOOR TILE indicated as VCT-1 in drawings

- A. Manufacturers: Basis-of-Design Product: Subject to compliance with requirements, provide AHF / Armstrong Flooring product indicated on Drawings or a comparable product by one of the following manufacturers:
1. Tarkett.
- B. Tile Standard: ASTM F 1066, Class 2, through pattern.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch (3.2 mm).

- E. Size: 12 by 12 inches (305 by 305 mm).
- F. Colors and Patterns: As indicated by manufacturer's designations.

### 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
  - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay tiles square with room axis.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
  - 1. Lay tiles with grain running in one direction in pattern indicated on Drawings.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.

- 1 C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and
- 2 placement of equipment and fixtures during remainder of construction period.
- 3 D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor
- 4 polish.
- 5 1. Apply three coats.
- 6 E. Cover floor tile until Substantial Completion.
- 7 END OF SECTION 096519

## SECTION 096623 – RESINOUS MATRIX TERRAZZO FLOORING

## PART 1 - GENERAL

## 1.1 SUMMARY

A. This Section includes the following:

1. Thin-set epoxy-resin terrazzo flooring.
2. Precast epoxy-resin terrazzo units.

## 1.2 SUBMITTALS

A. Product Data: For each type of terrazzo and accessory indicated.

B. Shop Drawings: Include terrazzo fabrication and installation requirements. Include plans, sections, component details, and attachments to other Work. Show layout of the following:

1. Divider and control- and expansion-joint strips.
2. Base and border strips.
3. Abrasive strips.
4. Terrazzo patterns.
5. Large scale details of terrazzo patterns and metal or other material inserts.

C. Samples for Initial Selection:

1. NTMA color plates showing the full range of colors and patterns available for each terrazzo type indicated.
2. Color plates, consisting of actual pieces 3 to 4 inches long by actual width, for abrasive stair strips.

D. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the Work in size indicated below:

1. Epoxy Terrazzo: 6-inch- square samples.
2. Precast Epoxy Terrazzo: 6-inch- square samples.
3. Accessories: 6-inch-long samples of each exposed strip item required.

E. Maintenance Data: For epoxy terrazzo to include in maintenance manuals.

F. Manufacturer Experience: Furnish list of at least five (5) epoxy terrazzo projects using material being submitted for this project installed during the past five (5) years of the same scope, complexity and at least 50% of the square footage, including the same items as in (H) below.

G. Installer Certificates: Submit proof of contractor and epoxy supplier membership in N.T.M.A.

H. Qualification Data: Terrazzo Contractor Experience: Furnish list of at least five (5) epoxy terrazzo projects using material specified for this project or similar that contractor has installed during the past five (5) years of the same scope, complexity and at least 50% of the square footage, including the following:

1. Project name.

- 1 2. Square footage of terrazzo installed.
- 2 3. Address of facility with contact name and phone number.
- 3 4. Contact name, address and phone number of prime contractor or construction manager.
- 4 5. Field experience resumes of key project personnel including lead supervisor and field technicians
- 5 to be used on this project.

- 6 I. Material Test Reports: For epoxy terrazzo and moisture test.

7 1.3 QUALITY ASSURANCE

- 8 A. Installer Qualifications: A qualified installer (applicator) who is acceptable to epoxy terrazzo
- 9 manufacturer to install manufacturer's products.

- 10 1. Terrazzo Contractor Qualifications: Use resin manufacturer certified terrazzo contractor with at
- 11 least five (5) years of satisfactory experience in installation of resinous epoxy terrazzo with proof
- 12 of N.T.M.A. membership. Terrazzo contractor shall demonstrate experience during last five (5)
- 13 years of at least three (3) projects of comparable scope and complexity of at least 50% of total
- 14 square footage of this project. (See experience criteria in Submittals section.)

- 15 B. Source Limitations:

- 16 1. Obtain primary terrazzo materials through one source from a single manufacturer. Provide
- 17 secondary materials including patching and fill material, joint sealant, and repair materials of type
- 18 and from source recommended by manufacturer of primary materials.
- 19 2. Obtain aggregates, solvents and other secondary materials from source recommended by
- 20 manufacturer of primary materials.

- 21 C. NTMA Standard: Comply with NTMA Guide Specification and written recommendations for terrazzo
- 22 type indicated unless more stringent requirements are specified.

- 23 D. Mockups: Install mockups to verify selections made under sample Submittals and to demonstrate
- 24 aesthetic effects and qualities of materials and execution.

- 25 1. For epoxy terrazzo, install mockups of at least 8 sq. ft. of typical flooring and base condition for
- 26 each color and pattern in locations directed by Architect.
- 27 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial
- 28 Completion.

- 29 E. Preinstallation Conference: Conduct conference at Project. Review methods and procedures related to
- 30 terrazzo including, but not limited to, the following:

- 31 1. Inspect and discuss installation procedures, joint details, jobsite conditions, substrate specification,
- 32 vapor barrier details and coordination with other trades.
- 33 2. Review and finalize construction schedule and verify availability of materials, Installer's
- 34 personnel, equipment, and facilities needed to make progress and avoid delays.
- 35 3. Review special terrazzo designs and patterns.
- 36 4. Review dust-control procedures.
- 37 5. Review plans for concrete curing and site drying to enable timely achievement of suitable slab
- 38 moisture conditions per Section 1.7 A.
- 39

40 1.4 WARRANTY

- 41 A. Terrazzo contractor jointly with manufacturer shall furnish standard guarantee of Epoxy Terrazzo
- 42 Flooring System for one year after installation. This labor and material guarantee includes loss of bond
- 43 and damage due to normal wear and tear.

- 1 B. Not included is damage due to bubbling or loss of adhesion due to moisture penetration through the  
2 substrate, Acts of God or other elements beyond scope of protection of this system. Also excluded are  
3 reflective cracks from substrate.
- 4 C. In case of warranty claim, owner will notify manufacturer and terrazzo contractor in writing within 30  
5 days of first appearance of any problems which are covered under this warranty, and will provide free  
6 access to area during normal working hours. Property protection is also the owner's responsibility.  
7 Remedy is limited to direct repair of Epoxy Terrazzo Flooring System

8 1.5 MATERIAL DELIVERY, HANDLING AND STORAGE

- 9 A. Primary system materials shall be delivered in manufacturer's undamaged, unopened containers. Each  
10 container shall be clearly marked with the following:  
11 1. Product name  
12 2. Manufacturer's name  
13 3. Component designation (A or B, etc.)  
14 4. Ratio of component mixture  
15 5. CHEMTREC Emergency Response Information
- 16 B. Handle materials by methods which prevent damage
- 17 C. Inspect direct jobsite deliveries to assure that quantities are correct and that materials comply with  
18 requirements and are not damaged.
- 19 D. Replace, at no cost to Owner, material found to be defective in manufacturing or that was damaged in  
20 transit, handling or storage.
- 21 E. Store materials per manufacturer's instructions and as follows:  
22 1. Seals and labels shall be intact and legible.  
23 2. Temperature of storage area shall be maintained between 55° F (12.8° C) and 90° F (32.2° C).  
24 3. Do not use materials which have been stored for a longer period of time than the manufacturer's  
25 maximum recommended shelf life

26 1.6 PROJECT CONDITIONS

- 27 A. Terrazzo contractor shall, prior to surface preparation:  
28 1. Evaluate slab condition, including slab moisture content and extent of repairs required, if any.  
29 2. Test concrete substrates according to ASTM F2170 (Determining Relative Humidity in Concrete  
30 Floor Slabs Using in situ Probes). Do not install terrazzo or terrazzo accessories until test results  
31 are 80% or less RH. If 80% RH is not met, consult terrazzo manufacturer for additional drying or  
32 negative side moisture mitigation methods.
- 33 B. Prior to and during each day of installation, the terrazzo contractor shall verify that the dew point is at  
34 least 5° F (-15° C) less than the slab and air temperature.
- 35 C. Protect surrounding substrates and surfaces, as well as in-place equipment from damage during surface  
36 preparation and system application.
- 37 D. Job area shall be free of other trades during surface preparation, crack detailing, divider strip installation,  
38 terrazzo pouring, and for a period of 36 hours upon completion. Provide coordination between terrazzo  
39 contractor and general contractor or construction manager as to types of traffic allowed on poured  
40 terrazzo after pouring but before coarse grinding, or after grouting but before polishing. Once polished,  
41 job area shall be free of other trades until 36 hours after completion of seal coat.



- E. General contractor shall insure that drains in installation area must be working and raised or lowered to actual finish elevation of terrazzo.
- F. General contractor shall provide ventilation by use of fans or other devices.
- G. The general contractor shall maintain lighting at minimum uniform level of 50-60 foot candles (538.2 Lux – 645.8 Lux) in areas where terrazzo system is being installed. If possible, schedule terrazzo installation so that permanent lights will be in place and working during installation.
- H. General contractor shall ensure that leaks from pipes and other sources are corrected prior to flooring installation.
- I. General contractor shall provide minimum substrate and atmospheric temperature of 55° F (12.8° C) during stripping and pouring and until 48 hours after completion of pouring. General contractor or construction manager shall not allow substrate or air temperature to fall below 40° F (4.4° C) after terrazzo has been poured.
- J. General contractor shall provide protection from other trades prior to final acceptance of owner.

## PART 2 - PRODUCTS

### 2.1 EPOXY RESIN TERRAZZO

- A. Epoxy Resin Terrazzo Systems Overview: The Basis of Design is Master Terrazzo Technologies, Levittown, PA ([www.MasterTerrazzo.com](http://www.MasterTerrazzo.com)). Prior to system application, treat cracks with MasterFlex Membrane and fill substrate irregularities with MorriFill Epoxy Fill as described in the Execution section. Fill referenced joints with ColorFlex Epoxy Sealant. Seal system with appropriate Master Terrazzo provided sealer.
- B. Thickness: 3/8 inch.
- C. Materials:
1. Epoxy Resin: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
    - a. Physical Properties without Aggregates:
      - 1) Hardness: 70-85 per ASTM D 2240, Shore D.
      - 2) Minimum Tensile Strength: 4,800 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
      - 3) Minimum Compressive Strength: 12,000 psi per ASTM D 695, Specimen B cylinder.
      - 4) Chemical Resistance: No deleterious effects by contaminants listed below after 7-day immersion at room temperature per ASTM D 1308.
        - a) Distilled water.
        - b) Mineral water.
        - c) Isopropanol.
        - d) Ethanol.
        - e) 0.025 percent detergent solution.
        - f) 1.0 percent soap solution.
        - g) 10 percent sodium hydroxide.
        - h) 10 percent hydrochloric acid.

- 1 i) 30 percent sulfuric acid.
- 2 j) 5 percent acetic acid.
- 3 b. Physical Properties with Aggregates: For terrazzo blended according to manufacturer's
- 4 recommendations with one part epoxy resin with three parts marble aggregate consisting of
- 5 60 percent No. 1 chips and 40 percent No. 0 chips that is ground and grouted to a 1/4-inch
- 6 nominal thickness, and cured for 7 days at 75 deg F plus or minus 2 deg F and at 50 percent
- 7 plus or minus 2 percent relative humidity.
- 8 1) Flammability: Self-extinguishing, maximum extent of burning 0.25 inch per
- 9 ASTM D 635.
- 10 2) Linear Coefficient of Thermal Expansion: 0.0025 inch/inch per deg F according to
- 11 ASTM C531.
- 12 2. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious
- 13 or foreign matter.
- 14 a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
- 15 b. 24-Hour Absorption Rate: Less than 0.75 percent.
- 16 c. Dust Content: Less than 1.0 percent by weight.
- 17 3. Flexible Epoxy Membrane: MasterFlex Flexible Epoxy Membrane, 100% solids with the
- 18 following properties:
- 19 a. Tensile Strngth: ASTM D 2370, 68° F (20° C) 1,500 psi (10.3 mPA)
- 20 b. Elongation: ASTM D 2370, 68° F (20° C) 130%
- 21 4. Primer: Morricite Primer, 100% solids, moisture insensitive. No solvent containing primers are
- 22 allowed.
- 23 5. Divider-Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this
- 24 use and acceptable to terrazzo manufacturer.
- 25 6. Finishing Grout: Morricite Terrazzo Grout, 100% Solids.
- 26 7. Seal Coat: Slip resistant, thin-coat terrazzo sealer of or approved by terrazzo manufacturer.
- 27 8. Control Joint Filler: MTT ColorFlex 100% Solids Flexible, Grindable Epoxy Joint Filler in color
- 28 selected by architect to match/compliment terrazzo with the following properties:
- 29 a. Tensile Strength ASTM D 2370 @ 68° F (20° C) 1,600 psi (11.03 mPA)
- 30 b. Elongation ASTM D 2370 @ 68° F (20° C) 100%
- 31 c. Tensile Modulus ASTM D 2370 @ 68° F (20° C) 27,800 psi (191.67 mPA)
- 32
- 33 D. Mix: Comply with NTMA's "Guide Specification for Epoxy Terrazzo" and manufacturer's written
- 34 instructions for component proportions and mixing.
- 35 1. Color and Pattern: Match architects sample prepared by Roman Mosaic and Tile Company, 1105
- 36 Saunders Lane, West Chester, PA 19380.
- 37 a. Sample WC2372-TZ-1 (Date: 01/29/24)
- 38 2.2 PRECAST EPOXY-RESIN TERRAZZO
- 39 A. Precast Terrazzo Base: Minimum 3/8-inch-thick, epoxy terrazzo units cast in maximum lengths possible,
- 40 but not less than 36 inches. Comply with manufacturer's written instructions for fabricating precast
- 41 terrazzo base units in sizes and profiles indicated.

1. Type: 6" high straight base.
2. Top Edge: Beveled with polished top surface.
3. Metal Toe Strip: Zinc.
4. Outside Corner Units: With finished returned edges at outside corner.
5. Color, Pattern, and Finish: Match Architect's sample.

- B. Precast Terrazzo Treads and Landing Units: Epoxy terrazzo units in profiles indicated. Comply with manufacturer's written instructions for fabricating precast units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer. Finish exposed-to-view edges and reveals to match face finish. Ease exposed edges to 1/8-inch radius.

1. Color, Pattern, and Finish: Match Architect's sample.

## 2.3 DIVIDER AND ACCESSORY STRIPS

- A. Heavy-Top Divider Strips: Angle type in depth required for topping thickness indicated.

1. Bottom-Section Material: Matching top-section material.
2. Top-Section Material: White zinc alloy or Aluminum, as required to produce pattern indicated.
3. Top-Section Width: 1/8 inch.

- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.

- C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Base bead and base dividers.

## 2.4 MISCELLANEOUS ACCESSORIES

- A. Patching and Fill Material: Resinous product of or approved by terrazzo manufacturer and recommended by manufacturer for application indicated.

- B. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected. Examine areas to receive terrazzo for:

1. Defects in existing work that affect proper execution of terrazzo work
2. Deviations beyond allowable tolerances for the concrete slab work.
3. Age (minimum 30 days) and moisture content of concrete slab. If concrete substrate moisture exceeds 80% according to ASTM F2170 (Determining Relative Humidity in Concrete Floor Slabs Using in site Probes), consult terrazzo manufacturer for additional drying or negative side moisture mitigation methods.
4. Start work only when all defects are corrected.

## 3.2 PREPARATION

- A. Clean substrates of substances that might impair epoxy terrazzo bond, including oil, grease, and curing compounds.
- B. Provide clean, dry, and neutral substrate for terrazzo application. Determine dryness characteristics by performing moisture tests recommended by terrazzo manufacturer.
1. Concrete: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with epoxy terrazzo.
    - a. Prepare concrete substrate to "open" surface pores by means of vacuum shotblasting or with a terrazzo grinder, dry with coarse diamond stones with a vacuum unit. Surface preparation results should achieve a CSP3-CSP5 profile according to International Concrete Repair Institute Guideline No. 03732. Remove all contaminating or bond breaking substances including but not limited to dust, laitance, curing compounds, coatings, sealers, oil, grease and carpet or vinyl mastics or adhesives. Any oil or grease not removed by vacuum blasting must be chemically removed. All spalled or deteriorated concrete should be mechanically removed by scabbling or chipping hammers. Acid etching is not acceptable.
    - b. Repair or level damaged concrete with MorriFill Epoxy Fill Mortar. Latex fills or self leveling underlayments are not acceptable.
    - c. Cracks and non-expansion joints greater than 1/16" (1.6mm) wide after surface preparation shall be prepared until sound.
- C. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

## 3.3 EPOXY TERRAZZO INSTALLATION WITH FULL MEMBRANE

## A. General:

1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
2. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Guide Specification for Epoxy Terrazzo."
3. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
4. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

## B. Flexible Reinforcing Membrane:

1. Prepare and prefill substrate cracks with MorriFill or Morricite Primer and allow to cure.
2. Install MasterFlex at 25 mils over prepared substrate to produce full substrate coverage in areas to receive terrazzo.
3. Install second coat of Master Flex at 15 mils and reinforce with MasterFlex fabric.
4. Prepare membrane according to manufacturer's written instructions before applying primer or Morricite.

## C. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.

- 1 D. Divider and Accessory Strips: Install, in locations approved by Architect, in adhesive setting bed without  
2 voids below strips.
- 3 E. Control Joint Strips: Install back to back over MasterFlex Membrane parallel to control and non-doweled  
4 construction joints leaving a space appropriate for anticipated movement- typically 1/4" – 3/8" (6.35 mm  
5 – 9.5 mm). Fill gap between control joints with ColorFlex Flexible Epoxy Joint Sealant.
- 6 F. Rough Grinding: Grind with 24 or finer grit stones or with comparable diamond plates.
- 7 G. Intermediate Grinding: Follow initial grind with 80 or finer grit stones.
- 8 H. Grouting:  
9 1. Cleanse floor with clean water and rinse thoroughly.  
10 2. Remove excess rinse water by wet vacuum and machine until completely dry.  
11 3. Apply epoxy grout to fill voids.
- 12 I. Fine Grinding: Grind with 120 or finer grit stones until all grout is removed from surface. Repeat rough  
13 grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with  
14 a minimum of 70 percent aggregate exposure.
- 15 J. Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in  
16 panels defined by strips and replace to match adjacent terrazzo.
- 17 K. Construction Tolerances: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet.

#### 18 3.4 POURED-IN-PLACE TERRAZZO INSTALLATION

- 19 A. General:
- 20 1. Comply with NTMA's written recommendations for terrazzo and accessory installation.  
21 2. Place underbed, slurry, terrazzo mixture according to manufacturer's written instructions and  
22 NTMA's guide specifications.  
23 3. Roll, compact, cure, and finish terrazzo according to manufacturer's written instructions and  
24 NTMA's guide specifications.  
25 4. Delay fine grinding until heavy trade work is complete and construction traffic through area is  
26 restricted.  
27 a. Fine grinding shall match epoxy terrazzo.
- 28 B. Abrasive Inserts: Install abrasive inserts parallel to stair nose, at spacings indicated, according to  
29 manufacturer's written instructions and NTMA's guide specifications.  
30 1. Abrasive inserts to be manufacturer's standard poured-in-place mixture, crown top approximately  
31 1/16-inch above terrazzo tread.

#### 32 3.5 PRECAST TERRAZZO INSTALLATION

- 33 A. Install precast terrazzo units using method recommended in writing by NTMA and manufacturer unless  
34 otherwise indicated.
- 35 B. Do not install units that are chipped, cracked, discolored, or improperly finished.
- 36 C. Seal joints between units with joint compound matching precast terrazzo matrix.

- 1 3.6 CLEANING AND PROTECTING
- 2 A. Remove grinding dust from installation and adjacent areas.
- 3 B. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written
- 4 instructions; rinse surfaces with water and allow to dry thoroughly.
- 5 C. Seal surfaces according to NTMA's written recommendations. Apply sealer according to sealer
- 6 manufacturer's written instructions.
- 7 D. Provide final protection and maintain conditions, in a manner acceptable to Installer, that will ensure
- 8 terrazzo is without damage or deterioration at time of Substantial Completion.
- 9 END OF SECTION 096623

1 SECTION 096723 - RESINOUS FLOORING

2 PART 1 - GENERAL

3 1.1 SUMMARY

- 4 A. Section Includes: Resinous flooring systems.

5 1.2 PREINSTALLATION MEETINGS

- 6 A. Preinstallation Conference: Conduct conference at Project site.

7 1.3 ACTION SUBMITTALS

- 8 A. Product Data: For each type of product. Include manufacturer's technical data, application instructions,  
9 and recommendations for each resinous flooring component required.

- 10 B. Samples for Initial Selection: For each type of exposed finish required.

- 11 C. Samples for Verification: For each resinous flooring system required, 12 inches (300 mm) square,  
12 applied to a rigid backing by Installer for this Project.

13 1.4 INFORMATIONAL SUBMITTALS

- 14 A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified  
15 requirements.

- 16 B. Material Certificates: For each resinous flooring component, from manufacturer.

- 17 C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.

18 1.5 CLOSEOUT SUBMITTALS

- 19 A. Maintenance Data: For resinous flooring to include in maintenance manuals.

20 1.6 QUALITY ASSURANCE

- 21 A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

- 22 B. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply  
23 resinous flooring systems indicated.

- 24 C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate  
25 aesthetic effects and set quality standards for materials and execution.

- 26 1. Apply full-thickness mockups on 96-inch- (2400-mm-) square floor area selected by Architect.

- 27 a. Include 48-inch (1200-mm) length of integral cove base with inside and outside corner.

2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing according to ASTM D 635.

#### 2.2 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

#### 2.3 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
- B. Basis-of-Design Products: Subject to compliance with requirements, provide Stonhard, Inc. (stonhard.com); Stonclad GS, including the following components:
  1. Primer: Standard Primer.
  2. Mortar Base: Stonclad GS.
  3. Topcoat: Stonkote GS4.
- C. Comparable Manufacturers: Subject to compliance with requirements, provide the basis-of-design products or comparable products by one of the following:



1. Duraflex, Inc.
  2. EconoSurf.
  3. General Polymers; Sherwin Williams.
- D. System Characteristics:
1. Color and Pattern: As selected by Architect from manufacturer's standard.
  2. Wearing Surface: Manufacturer's standard wearing surface.
  3. Overall System Thickness: 1/4 inch (6.4 mm).
- E. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- F. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- G. Body Coats:
1. Resin: Epoxy.
  2. Application Method: Troweled or screeded.
  3. Aggregates: Manufacturer's standard.
- H. Topcoats: Sealing or finish coats.
1. Type: Pigmented.
- I. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
1. Compressive Strength: 10,000 psi minimum according to ASTM C 579.
  2. Tensile Strength: 1,750 minimum according to ASTM C 307.
  3. Flexural Strength: 4,000 psi minimum according to ASTM C 580.
  4. Water Absorption: 0.2 percent maximum according to ASTM C 413.
  5. Impact Resistance: No chipping, cracking, or delamination when subjected to 160 in/lbs. according to ASTM D 2794.
  6. Abrasion Resistance: 0.1 gm maximum weight loss according to ASTM D 4060.
  7. Hardness: 85-90, Shore D according to ASTM D 2240.
  8. Critical Radiant Flux: 0.45 W/sq. cm or greater according to NFPA 253.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
1. Roughen concrete substrates using one of the following methods, as recommended in writing by resinous flooring manufacturer:

- a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
  - b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
  3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions using one of the following methods, as recommended in writing by resinous flooring manufacturer:
    - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate recommended by manufacturer.
    - b. Plastic Sheet Test: ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
    - c. Relative Humidity Test: Use in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
  4. Alkalinity and Adhesion Testing: Verify that concrete substrates have neutral pH within acceptable range. Perform tests recommended by manufacturer to verify adhesion of resinous flooring. Proceed with application only after substrates successfully pass testing.
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- 3.2 APPLICATION
- A. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
  2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
1. Integral Cove Base: 6 inches (150 mm) high.
  2. Provide metal cap for integral flash cove base approved by resinous flooring manufacturer.

- 1 D. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for  
2 flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove  
3 trowel marks and roughness using method recommended by manufacturer.
- 4 E. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended  
5 in writing by manufacturer and to produce wearing surface indicated.

6 3.3 PROTECTION

- 7 A. Protect resinous flooring from damage and wear during the remainder of construction period. Use  
8 protective methods and materials, including temporary covering, recommended in writing by resinous  
9 flooring manufacturer.

10 END OF SECTION 096723

## 1 SECTION 096813 - TILE CARPETING

## 2 PART 1 - GENERAL

## 3 1.1 SUMMARY

## 4 A. Section Includes:

- 5 1. Modular carpet tile.
- 6 2. Carpet tile entrance mats.

## 7 B. Related Requirements:

- 8 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed
- 9 with carpet tile.

## 10 1.2 PREINSTALLATION MEETINGS

## 11 A. Preinstallation Conference: Conduct conference at Project site.

- 12 1. Review methods and procedures related to carpet tile installation including, but not limited to, the
- 13 following:
- 14 a. Review ambient conditions and ventilation procedures.
- 15 b. Review subfloor preparation procedures.

## 16 1.3 ACTION SUBMITTALS

## 17 A. Product Data: For each type of product.

- 18 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- 19 2. Include manufacturer's written installation recommendations for each type of substrate.

## 20 B. Shop Drawings: For carpet tile installation, plans showing the following:

- 21 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts
- 22 are required in carpet tiles.
- 23 2. Carpet tile type, color, and dye lot.
- 24 3. Type of subfloor.
- 25 4. Type of installation.
- 26 5. Pattern of installation.
- 27 6. Pattern type, location, and direction.
- 28 7. Pile direction.
- 29 8. Type, color, and location of edge, transition, and other accessory strips.
- 30 9. Transition details to other flooring materials.

## 31 C. Samples for Initial Selection: For each type of carpet tile.

- 32 1. Include Samples of exposed edge, transition, and other accessory stripping involving color or
- 33 finish selection.

34 D. Samples for Verification: For each of the following products and for each color and texture required.  
35 Label each Sample with manufacturer's name, material description, color, pattern, and designation  
36 indicated on Drawings and in schedules.

- 37 1. Carpet Tile: Full-size Sample.
- 38 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

#### 1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II or Master II certification level.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI's "CRI Carpet Installation Standard."

#### 1.9 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

## 1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  2. Failures include, but are not limited to, the following:
    - a. More than 10 percent edge raveling, snags, and runs.
    - b. Dimensional instability.
    - c. Excess static discharge.
    - d. Loss of tuft-bind strength.
    - e. Loss of face fiber.
    - f. Delamination.
  3. Warranty Period: Not less than 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 CARPET TILE CPT-1 , CPT-2, CPT-3, and CPT-4

Basis-of-design Product: Provide products indicated on Drawings or a comparable product by one of the following manufacturers:

1. Patcraft.
2. Milliken.

## B. Product Characteristics:

1. Color: As indicated by manufacturer's designations.
2. Pattern: As indicated by manufacturer's designations.
3. Backing System: Manufacturer's standard.
4. Size: As indicated.

## 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.

- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
- a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
- b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI's "CRI Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

- 1 G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by  
2 repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- 3 H. Install pattern parallel to walls and borders.

4 3.4 CLEANING AND PROTECTION

- 5 A. Perform the following operations immediately after installing carpet tile:
- 6 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile  
7 manufacturer.
- 8 2. Remove yarns that protrude from carpet tile surface.
- 9 3. Vacuum carpet tile using commercial machine with face-beater element.
- 10 B. Protect installed carpet tile to comply with CRI's "CRI Carpet Installation Standard," Section 20,  
11 "Protecting Indoor Installations."
- 12 C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures  
13 during the remainder of construction period. Use protection methods indicated or recommended in  
14 writing by carpet tile manufacturer.

15 END OF SECTION 096813



## 1 SECTION 099000 - PAINTING AND COATING

## 2 PART 1 - GENERAL

## 3 1.1 SUMMARY

4 A. Section Includes: Surface preparation and the application of paint systems on exterior and interior  
5 substrates.

6 B. Paint exposed exterior and interior substrates, except where schedules indicate that a surface or material  
7 is not to be painted or is to remain natural. If schedules do not specifically mention an item or a surface,  
8 paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules  
9 indicate colors. If schedules do not indicate color or finish, the Architect will select from standard colors  
10 and finishes available.

11 1. Do not paint prefinished items, integrally finished systems, finished metal surfaces, operating  
12 parts, and labels, unless otherwise indicated.

13 2. Prefinished items include the following shop- or factory-finished components:

14 a. Toilet compartments.

15 b. Prefinished lockers.

16 c. Finished mechanical and electrical equipment.

17 d. Lighting fixtures.

18 3. Finished metal surfaces include the following:

19 a. Anodized aluminum.

20 b. Stainless steel.

21 c. Chromium plate.

22 d. Copper.

23 e. Bronze and brass.

24 C. Related Requirements:

25 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers  
26 specified in this Section.

## 27 1.2 DEFINITIONS

28 A. Gloss Level 1 (Flat): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to  
29 ASTM D 523.

30 B. Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to  
31 ASTM D 523.

32 C. Gloss Level 4 (Satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to  
33 ASTM D 523.

34 D. Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 degrees, according to ASTM D 523.

35 E. Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat; cured not less than 7 days.
1. Submit Samples on rigid backing, 12 inches (300 mm) square.
  2. Label each coat of each Sample.
  3. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  3. VOC content.

## 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

## 1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
  2. Lighting: Do not apply mockups until a permanent level of lighting is provided on the surfaces to receive paint.
  3. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
  4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

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

## 1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

- C. Provide adequate ventilation, including mechanical ventilation, to remove paint odors and fumes from areas of the building where odors might migrate to occupied spaces.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products by The Sherwin-Williams Company or one of the following:

1. Benjamin Moore & Co.
2. PPG Architectural Coatings.

## 2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

- B. Material Quality: Unless otherwise indicated, provide manufacturer's best-quality paint material for each coating type.

- C. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- D. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

- E. Colors: As indicated in a schedule, or if not indicated, as selected by Architect from manufacturer's full range.

## 2.3 SOURCE QUALITY CONTROL

## A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Concrete: 12 percent.
  2. Masonry (CMU): 12 percent.
  3. Wood: 15 percent.
  4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

## 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Wood Substrates:
  1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
  2. Sand surfaces that will be exposed to view, and dust off.
  3. Prime edges, ends, faces, undersides, and backsides of wood.
  4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
  1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view on exterior:

- a. Uninsulated metal piping.
- b. Uninsulated plastic piping.
- c. Pipe hangers and supports.
- d. Metal conduit.
- e. Plastic conduit.
- f. Tanks that do not have factory-applied final finishes.

2. Paint the following work where exposed in equipment rooms:

- a. Uninsulated metal piping.
- b. Uninsulated plastic piping.
- c. Pipe hangers and supports.
- d. Metal conduit.
- e. Plastic conduit.
- f. Tanks that do not have factory-applied final finishes.
- g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

3. Paint the following work where exposed in occupied spaces:

- a. Equipment, including panelboards.
- b. Uninsulated metal piping.
- c. Uninsulated plastic piping.
- d. Pipe hangers and supports.
- e. Metal conduit.
- f. Plastic conduit.
- g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
- h. Other items as directed by Architect.

4. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

- 1. Contractor shall touch up and restore painted surfaces damaged by testing.
- 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 EXTERIOR PAINTING SCHEDULE

#### A. Galvanized-Metal Substrates:

##### 1. Water-Based Light Industrial Coating System:

- a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
- b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (Gloss Level 5), MPI #163.

### 3.7 INTERIOR PAINTING SCHEDULE

#### A. Concrete Substrates, Nontraffic Surfaces where identified as receiving paint:

##### 1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 4), MPI #146.

#### B. CMU Substrates:

##### 1. Institutional Low-Odor/VOC Latex System:

- a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 4), MPI #146.

##### 2. Epoxy-Modified Latex System:

- a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
- b. Intermediate Coat: Epoxy-modified latex, interior, gloss (Gloss Level 6), MPI #115.
- c. Topcoat: Epoxy-modified latex, interior, gloss (Gloss Level 4).

#### C. Steel Substrates, Overhead Surfaces: Including structural steel, metal deck, piping, and similar items.

##### 1. Water-Based Dry-Fall System:

- a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79 or primer, alkyd, quick dry, for metal, MPI #76.
- b. Prime Coat: Shop primer specified in Section 051200 "Structural Steel Framing" where substrate is specified.

- 1 c. Topcoat: Dry fall, latex, flat, MPI #118.
- 2 D. Steel Substrates, Typical Locations.
- 3 1. Institutional Low-Odor/VOC Latex System:
- 4 a. Prime Coat: Primer, rust-inhibitive, water based MPI #107.
- 5 b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- 6 c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss
- 7 Level 5), MPI #147.
- 8 E. Galvanized-Metal Substrates, Overhead Surfaces: Including uninsulated metal ductwork, conduit, and
- 9 similar items.
- 10 1. Water-Based Dry-Fall System:
- 11 a. Prime Coat: Dry fall, water based, for galvanized steel, flat (Gloss Level 1), MPI #133.
- 12 b. Topcoat: Dry fall, water based, for galvanized steel, flat (Gloss Level 1), MPI #133.
- 13 F. Galvanized-Metal Substrates; Typical Locations:
- 14 1. Institutional Low-Odor/VOC Latex System:
- 15 a. Prime Coat: Primer, galvanized, water based, MPI #134.
- 16 b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- 17 c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss
- 18 Level 5), MPI #147.
- 19 G. Wood Substrates: Including wood trim and wood-based panel products.
- 20 1. Institutional Low-Odor/VOC Latex System:
- 21 a. Prime Coat: Primer, latex, for interior wood, MPI #39.
- 22 b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- 23 c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss
- 24 Level 5), MPI #147.
- 25 H. Gypsum Board Substrates:
- 26 1. Institutional Low-Odor/VOC Latex System: For typical locations.
- 27 a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
- 28 b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- 29 c. Topcoat: Latex, interior, institutional low odor/VOC, eggshell (Gloss Level 3), MPI #146.
- 30 2. Epoxy-Modified Latex System: For locations including kitchens, laundries, toilet rooms, showers,
- 31 and janitor or custodial closets.
- 32 a. Prime Coat: Primer sealer, latex, interior, MPI #50.
- 33 b. Intermediate Coat: Epoxy-modified latex, interior, gloss (Gloss Level 6), MPI #115.
- 34 c. Topcoat: Epoxy-modified latex, interior, gloss (Gloss Level 6), MPI #115.
- 35



- 1 I. Insulation-Covering Substrates: Including pipe and duct coverings.
- 2 1. Institutional Low-Odor/VOC Latex System:
- 3 a. Prime Coat: Primer sealer, latex, interior, MPI #50.
- 4 b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- 5 c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 4), MPI #146.
- 6 END OF SECTION 099000

1 SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Cutout dimensional characters.

9 1.3 ACTION SUBMITTALS

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

- 11 B. Shop Drawings: For signs.

- 12 1. Include fabrication and installation details and attachments to other work.  
13 2. Show sign mounting heights, locations of supplementary supports to be provided by other  
14 installers, and accessories.  
15 3. Show message list, typestyles, graphic elements, and layout for each sign to a scale no less than  
16 1-1/2 inches equals 12 inches.

- 17 C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

- 18 1. Include representative Samples of available typestyles and graphic symbols.

- 19 D. Samples for Verification: For each type of sign assembly showing all components and with the required  
20 finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

- 21 1. Dimensional Characters: Full-size Sample of each type of dimensional character.  
22 2. Exposed Accessories: Full-size Sample of each accessory type.

- 23 E. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or  
24 specified.

25 1.4 INFORMATIONAL SUBMITTALS

- 26 A. Sample Warranty: For special warranty.

27 1.5 CLOSEOUT SUBMITTALS

- 28 A. Maintenance Data: For signs to include in maintenance manuals.

1 1.6 FIELD CONDITIONS

- 2 A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other  
3 installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

4 1.7 WARRANTY

- 5 A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or  
6 workmanship within specified warranty period.

- 7 1. Failures include, but are not limited to, the following:

- 8 a. Deterioration of finishes beyond normal weathering.  
9 b. Separation or delamination of sheet materials and components.

- 10 2. Warranty Period: Five years from date of Substantial Completion.

11 PART 2 - PRODUCTS

12 2.1 PERFORMANCE REQUIREMENTS

- 13 A. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal  
14 movements from ambient and surface temperature changes.

- 15 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

16 2.2 DIMENSIONAL CHARACTERS

- 17 A. Cutout Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and  
18 profiles.

- 19 2. Character Material: Sheet or plate aluminum.

- 20 3. Character Height: As indicated on Drawings.

- 21 4. Thickness: 0.25 inch.

- 22 5. Finishes:

- 23 a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color matching  
24 Architect's sample.

- 25 b. Overcoat: Manufacturer's standard baked-on clear coating.

- 26 6. Mounting: Concealed studs.

- 27 7. Typeface: Match Typeface on Aston Township Community Center building located at 3270  
28 Concord Road, Aston, PA 19014.

29 2.3 DIMENSIONAL CHARACTER MATERIALS

- 30 A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting  
31 process used and for type of use and finish indicated.

- 32 B. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and  
33 finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

## 2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

3. Sign Mounting Fasteners:

- a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

## 2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

## 2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- 1 C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension  
2 of finished trim or border surface unless otherwise indicated.
- 3 D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before  
4 applying contrasting polished finishes on raised features unless otherwise indicated.

5 2.7 ALUMINUM FINISHES

- 6 A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5  
7 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and  
8 applying and baking finish.

9 PART 3 - EXECUTION

10 3.1 EXAMINATION

- 11 A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for  
12 installation tolerances and other conditions affecting performance.
- 13 B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or  
14 irregularities between backs of signs and support surfaces unless otherwise indicated.
- 15 C. Verify that electrical service is correctly sized and located to accommodate signs.
- 16 D. Proceed with installation only after unsatisfactory conditions have been corrected.

17 3.2 INSTALLATION

- 18 A. General: Install signs using mounting methods indicated and according to manufacturer's written  
19 instructions.

- 20 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces  
21 free of distortion and other defects in appearance.
- 22 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would  
23 impair installation.
- 24 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout,  
25 concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

26 B. Mounting Methods:

- 27 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign.  
28 Remove loose debris from hole and substrate surface.
- 29 a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced  
30 adhesive. Place sign in position and push until flush to surface, embedding studs in holes.  
31 Temporarily support sign in position until adhesive fully sets.
- 32 b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and  
33 nuts on studs projecting through opposite side of surface, and tighten.
- 34 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign.  
35 Remove loose debris from hole and substrate surface.

- a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
  - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
  4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
  5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
  6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

### 3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 102113 - METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Painted steel toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Requirements:
1. Section 061053 "Miscellaneous Rough Carpentry" for blocking.
  2. Section 102813 "Toilet Accessories" for toilet tissue dispensers, grab bars, and similar accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
1. Include plans, elevations, sections, and attachment details.
  2. Show locations of cutouts for compartment-mounted toilet accessories.
  3. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
  4. Show locations of centerlines of toilet fixtures.
  5. Show locations of floor drains, if applicable.
- C. Samples for Initial Selection: For each type of toilet compartment material indicated.
1. Include Samples of hardware and accessories involving material and color selection.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
  2. Each type of hardware and accessory.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

## 1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

## 2.2 PAINTED STEEL TOILET COMPARTMENTS

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

1. Bradley Corporation; Mills Partitions.
2. General Partitions Mfg. Corp.
3. Global Steel Products Corp.

- B. Toilet-Enclosure Style: Floor anchored with overhead brace.

- C. Urinal-Screen Style: Wall hung, flat panel.

- D. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and with exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
2. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units of size and material adequate for panel to withstand applied downward load on grab bar of at least 250 lbf (1112 N), when tested according to ASTM F 446, without deformation of panel.
3. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

- E. Urinal-Screen Construction:

1. Flat-Panel Urinal Screen: Matching panel construction.

- F. Facing Sheets and Closures: Electrolytically coated steel or hot-dip galvanized-steel sheet with nominal base-metal (uncoated) thicknesses as follows:

1. Pilasters: Manufacturer's standard thickness, but not less than 0.048 inch (1.21 mm).
2. Panels: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
3. Doors: Manufacturer's standard thickness, but not less than 0.030 inch (0.76 mm).
4. Flat-Panel Urinal Screens: Thickness matching the panels.



G. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

H. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets; clear-anodized aluminum.

I. Steel Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking.

1. Color: As selected by Architect from manufacturer's full range.

## 2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Clear-anodized aluminum.

2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.

3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.

4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.

5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.

6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

## 2.4 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).

C. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.

1. Electrolytically Zinc Coated: ASTM A 879/A 879M, 01Z (03G).

2. Hot-Dip Galvanized: ASTM A 653/A 653M, either hot-dip galvanized or galvanized.

## 2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.

- 1 B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with  
2 leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to  
3 conceal anchorage.
- 4 C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors  
5 for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-  
6 inch- (813-mm-) wide, clear opening for compartments designated as accessible.

## 7 PART 3 - EXECUTION

### 8 3.1 EXAMINATION

- 9 A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for  
10 fastening, support, alignment, operating clearances, and other conditions affecting performance of the  
11 Work.
- 12 1. Confirm location and adequacy of blocking and supports required for installation.
- 13 B. Proceed with installation only after unsatisfactory conditions have been corrected.
- 14 C. Coordinate layout and installation of supports, inserts, and anchors built into other units of work for toilet  
15 compartment anchorage.

### 16 3.2 INSTALLATION

- 17 A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level,  
18 and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.
- 19 1. Maximum Clearances:
- 20 a. Pilasters and Panels: 1/2 inch (13 mm).  
21 b. Panels and Walls: 1 inch (25 mm).
- 22 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets  
23 attached at midpoint and near top and bottom of panel.
- 24 a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.  
25 b. Align brackets at pilasters with brackets at walls.
- 26 B. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into  
27 structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and  
28 tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in  
29 closed position.
- 30 C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb,  
31 rigid, and secured to resist lateral impact.

### 32 3.3 ADJUSTING

- 33 A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written  
34 instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30

1 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully  
2 closed position.

3 END OF SECTION 102113

1 SECTION 102813 - TOILET ACCESSORIES

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. Section Includes:

5 1. Providing accessories of the types indicated, in the following categories:

- 6 a. Toilet room accessories.
- 7 b. Shower accessories.
- 8 c. Childcare accessories.
- 9 d. Custodial accessories.

10 2. Installation of Owner-furnished accessories of the types indicated.

11 B. Related Requirements:

12 1. Section 088300 "Mirrors" for frameless mirrors.

13 1.2 ACTION SUBMITTALS

14 A. Product Data: For each type of product indicated. Include the following:

- 15 1. Construction details and dimensions.
- 16 2. Anchoring and mounting requirements, including requirements for cutouts in other work and
- 17 substrate preparation.
- 18 3. Material and finish descriptions.
- 19 4. Features that will be included for Project.
- 20 5. Manufacturer's warranty.

21 B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory

22 required.

- 23 1. Identify locations using room designations indicated.
- 24 2. Identify products using designations indicated.

25 1.3 INFORMATIONAL SUBMITTALS

26 A. Warranty: Sample of special warranty.

27 1.4 CLOSEOUT SUBMITTALS

28 A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

## 1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

## 1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

## 2.2 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. American Specialties, Inc.

- 1 2. Bobrick Washroom Equipment, Inc.
- 2 3. Bradley Corporation.

3 2.3 TOILET ACCESSORIES

4 A. A - Grab Bar:

- 5 1. Basis-of-Design Product: Bradley; Model 832.
- 6 2. Mounting: Flanges with concealed fasteners.
- 7 3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
- 8 a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
- 9 4. Outside Diameter: 1-1/4 inches (32 mm).
- 10 5. Configuration and Length: As indicated on Drawings.

11 B. B - ADA Coat Hook:

- 12 1. Basis-of-Design Product: Bobrick; Model 7672.
- 13 2. Description: Surface-mounted single-prong unit with concealed mounting plate.
- 14 3. Material and Finish: Stainless steel, No. 4 finish (satin).

15 C. C Toilet Tissue (Roll) Dispenser: Owner-furnished units installed by Contractor.

16 D. D - Liquid-Soap Dispenser: Owner-furnished units installed by Contractor.

17 E. E - Combination Towel (Folded) Dispenser/Waste Receptacle: Owner-furnished units installed by  
18 Contractor.

19 F. F - Framed Mirror Unit:

- 20 1. Basis-of-Design Product: Bradley; Model 780.
- 21 2. Frame: Stainless-steel angle.
- 22 a. Corners: Welded and ground smooth.
- 23 3. Hangers: Produce rigid, tamper- and theft-resistant installation, using one of the following  
24 methods:
- 25 a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to  
26 hold mirror unit in position with no exposed screws or bolts.
- 27 b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a  
28 special tool to remove.
- 29 4. Size: 24 by 36 inches.

30 G. G Shower Curtain Rod, Hooks, Seat and Grab Bars:

- 31 1. Basis-of-Design Products: Bradley; Model 9538 Shower Curtain Rod and Model 9540 Shower  
32 Curtain Hook with Rollers and Model 9933 Shower Seat and Grab Bars (see accessory "A").
- 33 2. Description: 1-inch (25.4-mm) OD; fabricated from nominal 0.0375-inch- (0.95-mm-) thick  
34 stainless steel.
- 35 3. Mounting Flanges: Stainless-steel flanges designed for concealed mounting.
- 36 4. Finish: No. 4 (satin).

5. Hooks: Stainless-steel, spring wire curtain hooks with snap fasteners and rollers of brass with nickel plating, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
6. Seat: Bradley; Model 9933, 1 inch OD stainless steel tubing frame with 1-1/2" HDPE support bars, stainless steel wall bracket, stainless steel retaining bracket, and melamine laminated seat over 1/2-inch solid phenolic core. Seat is field convertible to left or right hand "L" chaped configuration. Positive catch holds seat in up or down position. Static load limit: 250 lbs. Seat color: white.

H. H Diaper-Changing Station:

1. Basis-of-Design Product: Koala Kare Products, a division of Bobrick Washroom Equipment, Inc.; KB200-00.
2. Description: Horizontal unit that opens by folding down from stored position, with reinforced steel hinge mechanism and metal mounting chassis, and with child-protection strap and bag hooks.
  - a. Engineered to support a minimum of 250-lb (113-kg) static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than 4 inches (100 mm) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Injection-molded polypropylene with antimicrobial additive, in color selected by Architect.
6. Liner Dispenser: Built in.

I. I - Shelf Unit:

1. Basis-of-Design Product: Bradley; Model SA49.
2. Description: Welded unit with welds ground smooth, corners polished and burr-free edges; with front edge turned down not less than 1/2 inch; and supported by two triangular brackets welded to shelf ends.
3. Anchorage: Welded anchor nuts on back of shelf to receive threaded studs.
4. Size: 16 inches long by 4 inches deep.
5. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, No. 4 finish (satin).

J. J - Utility Shelf:

1. Basis-of-Design Product: Bradley; Model 9933.
2. Description: Unit with shelf, hooks, and mop and broom holders.
3. Length: 34 inches (864 mm).
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
- a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## 1 PART 3 - EXECUTION

## 2 3.1 INSTALLATION

3 A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to  
4 substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly  
5 anchored in locations and at heights indicated.

6 B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to  
7 ASTM F 446.

## 8 3.2 ADJUSTING AND CLEANING

9 A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

10 B. Remove temporary labels and protective coatings.

11 C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

12 END OF SECTION 102813



1 SECTION 104413 - FIRE PROTECTION CABINETS

2 PART 1 - GENERAL

3 1.1 SUMMARY

- 4 A. Section Includes: Fire-protection cabinets for portable fire extinguishers.

5 1.2 ACTION SUBMITTALS

- 6 A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style.  
7 Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting  
8 method and relationships of box and trim to surrounding construction.

- 9 B. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface  
10 mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure  
11 proper fit and function. Use same designations indicated on Drawings.

12 1.3 CLOSEOUT SUBMITTALS

- 13 A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

14 1.4 COORDINATION

- 15 A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated  
16 are accommodated.

- 17 B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

18 PART 2 - PRODUCTS

19 2.1 MANUFACTURERS

- 20 A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source  
21 from single manufacturer

22 2.2 PERFORMANCE REQUIREMENTS

- 23 A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for  
24 fire-resistance rating of walls where they are installed.

25 2.3 FIRE-PROTECTION CABINET

- 26 A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - b. Larsens Manufacturing Company.
  - c. Safety One Industries.
- B. Cabinet Construction: Nonrated and One-hour fire rated.
  1. Provide fire-rate cabinets in locations where cabinet is mounted in a fire-rated partition.
  2. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
  1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Aluminum sheet.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Acrylic sheet.
  1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  1. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
  1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
  3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
    - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER" unless otherwise indicated or directed.
      - 1) Location: Applied to cabinet door.
      - 2) Application Process: Decals.
      - 3) Lettering Color: White.
      - 4) Orientation: Horizontal.

K. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
  - a. Finish: Baked enamel or powder coat.
  - b. Color: As selected by Architect from manufacturer's full range.
2. Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 (ASTM B 221M) for extruded shapes.
  - a. Finish: Clear anodic.
3. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 6 mm thick, with Finish 1 (smooth or polished).

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

## 3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction and as directed by Architect.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

## 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

1 SECTION 104416 - FIRE EXTINGUISHERS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section includes portable fire extinguishers and mounting brackets for fire extinguishers.

8 1.3 ACTION SUBMITTALS

- 9 A. Product Data: For each type of product. Include rating and classification, material descriptions,  
10 dimensions of individual components and profiles, and finishes for fire extinguisher and mounting  
11 brackets.

12 1.4 INFORMATIONAL SUBMITTALS

- 13 A. Warranty: Sample of special warranty.

14 1.5 CLOSEOUT SUBMITTALS

- 15 A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

16 1.6 COORDINATION

- 17 A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

18 1.7 WARRANTY

- 19 A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire  
20 extinguishers that fail in materials or workmanship within specified warranty period.

- 21 1. Failures include, but are not limited to, the following:

- 22 a. Failure of hydrostatic test according to NFPA 10.  
23 b. Faulty operation of valves or release levers.

- 24 2. Warranty Period: Six years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

## 2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS (MP-5)

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. J. L. Industries, Inc., Activar Construction Products Group.
    - b. Kidde, United Technologies.
    - c. Potter-Roemer; Member of Morris Group International.
  - 2. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
    - a. 16 gauge red glossy polyester coated steel bracket with spring type band.
- B. Multipurpose Dry-Chemical Type in Steel Container (MP-5): UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: Set bottom of extinguisher no higher than 26" AFF. In the event the top of the fire extinguisher extends above 48" when mounted at 26" AFF to the bottom of the unit, lower the extinguisher such that the height does not exceed 48" measured to the highest point of the fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

## SECTION 105113.02 - METAL PERSONNEL LOCKERS

## PART 1 GENERAL

## 1.1 SUMMARY

- A. Section Includes:
1. Metal personnel locker units with hinged doors.

## 1.2 REFERENCES

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

## 1.3 SYSTEM DESCRIPTION

- A. Metal Lockers:
1. Configuration: Single tier.
  2. Size: 18 inches wide x 24 inches deep x 72 inches high.
  3. Permit installation of an electrical system.
  4. Drawer units: Same width as locker x 18 inches high x 24 inches deep, installed under locker units.

**Commented [AH1]:** ADDED - TO BE THE SAME ON ILK & PLK UNITS

## 1.4 SUBMITTALS

- A. Submittals for Review:
1. Shop Drawings: Include dimensioned plans and elevations showing locker layout and relationship to adjacent construction.
  2. Product Data: Manufacturer's descriptive data.
  3. Samples: 3-1/4 x 1-1/2 inch paint samples.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10 years documented experience in work of this Section.

## 1.6 WARRANTIES

- A. Provide manufacturer's 5-year warranty against defects in materials and workmanship.

## PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Personnel Lockers by Steele Solutions or comparable products by one of the following manufacturers:
1. Southwest Solutions Group

## 2.2 MATERIALS

- A. Steel Sheet:
1. ASTM A1008/A1008M.

## 2.3 FABRICATION

- 1 A. Construction:
- 2 1. Doors: Minimum 16 gauge steel.
- 3 2. Back panels, top panels, and inner panels except inner doors: Minimum 20 gauge steel.
- 4 3. Side and bottom panels: Minimum 18 gauge steel.
- 5
- 6 B. Doors:
- 7 1. Louvered top and bottom.
- 8 2. Door hinges: 14 gauge steel, continuous type, concealed, 180 degree opening.
- 9
- 10 C. Frames:
- 11 1. Formed and welded into integrated units with doors installed.
- 12 2. Body parts flanged and angled to provide rigidity; assembled by welding, bolting, or riveting
- 13 using corrosion-resistant bolts and aluminum or stainless-steel rivets.
- 14 3. Provide mounting holes for attaching lockers back-to-back and side-by-side.
- 15
- 16 D. Internal Components:
- 17 1. Shelves:
- 18 a. One small and one large shelf.
- 19 b. One small shelf with valuables compartment.
- 20 2. Double hook for storage.
- 21 3. Single coat hook on each side panel.
- 22 4. Two (2) single prong hooks on inside of door.
- 23 5. Knockouts for electrical conduit; verify location in field.
- 24
- 25 E. Drawer Unit:
- 26 1. Minimum welded 18 gauge steel top, bottom, back, and sides.
- 27 2. Bottom and top open for access to fasten unit to floor and wall during installation, not requiring
- 28 removal of drawer.
- 29 3. Provide holes for attaching bench seat.
- 30 4. Keyless locking mechanism securing drawer when the door is closed. Released by pull handle
- 31 inside locker.
- 32 5. Maximum 200 pound load capacity on drawer slides.
- 33 6. Provide mounting tabs for attaching body armor drying rack.
- 34
- 35 F. Door Locks and Latches:
- 36 1. Lift latch operated, top and bottom bayonet style.
- 37 2. Recessed door latch, painted cup with integral door latch/pull, pry-resistant, not protruding
- 38 beyond face of door.
- 39 3. Locking Mechanism: Padlock hasp- shackle diameter to be used on Steele Solutions Infinity
- 40 Lockers is 0.250"-0.312".
- 41
- 42 G. Number Plates:
- 43 1. Number plates furnished loose and affixed to locker using pop rivets in pre-drilled holes in door.
- 44 2. Number doors as directed by Owner.
- 45
- 46 H. Accessories:
- 47 1. Continuous sloping tops, minimum 24 gauge steel. Field cut to size.
- 48 2. Finished end panels without exposed fasteners, minimum 16 gauge steel.
- 49 3. Filler panels, minimum 20 gauge steel. Field cut to size.
- 50 4. Modular electrical system.
- 51
- 52

**Commented [AH2]:** REVISED - TO BE THE SAME ON  
ILK AND PLK SPECS



## 2.4 FINISHES

## A. Steel:

1. Minimum 3 mil thick factory-applied baked-on textured powder coat finish.
2. Color: To be selected from manufacturer's full color range.

## PART 3 EXECUTION

## 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Set plumb, level, and aligned.
- C. Attach lockers to supporting construction with anchors best suited to substrate conditions.
- D. Bolt adjacent locker units together to provide rigid installation.
- E. Install slope tops, end panels, filler trim, drawer bases, and electrical.

## 3.2 ADJUSTING

- A. Adjust doors and latches to operate correctly.

## END OF SECTION

**Commented [AH3]:** REVISED - TO BE THE SAME ON  
ILK & PLK SPECS

1 SECTION 107310 – CANTILEVERED CANOPIES

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Manufactured canopy.  
9 2. Sun control device.

10 1.3 COORDINATION

- 11 A. Coordinate installation of anchorages for cantilevered canopies. Furnish setting drawings, templates, and  
12 directions for installing anchorages, including sleeves, inserts, and items with integral anchors, that are to  
13 be embedded in adjacent construction. Deliver such items to Project site in time for installation.

14 1.4 ACTION SUBMITTALS

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

- 16 1. Include construction details, material descriptions, dimensions of individual components and  
17 profiles, weights and finishes for window units.

- 18 B. Shop Drawings: For manufactured canopies and sun control devices.

- 19 1. Submit shop drawings showing structural component locations/positions, material dimensions and  
20 details of construction and assembly.  
21 2. Include plans, elevations, sections, and attachment details.  
22 3. Full-size section details of framing members, including internal armoring, reinforcement, and  
23 stiffeners.

- 24 C. Samples for Initial Selection: For frame members with factory-applied color finishes.

25 1.5 QUALITY ASSURANCE

- 26 A. Products meeting these specifications established standard of quality required as manufactured by Mapes  
27 Industries, Inc. Lincoln, Nebraska 1-888-273-1132.

28 1.6 PERFORMANCE REQUIREMENTS

- 29 A. Canopy shall conform to local building codes.

- 1 B. Professional Engineer stamped calculations are required and must be signed and sealed by an engineer  
2 licensed within the Commonwealth of Pennsylvania.

3 1.7 DELIVERY, STORAGE, AND HANDLING

- 4 A. Deliver and store all canopy components in protected, dry area.

5 1.8 FIELD CONDITIONS

- 6 A. Field Measurements: Verify actual dimensions of openings by field measurements prior to preparation of  
7 shop drawings when possible.

8 1.9 WARRANTY

- 9 A. Special Warranty: Manufacturer agrees to repair or replace manufactured canopies and sun control  
10 devices that fail in materials or workmanship within specified warranty period.

- 11 1. Failures include, but are not limited to, the following:  
12 2. Warranty Period: Three years from date of Substantial Completion.

- 13 B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or metal that  
14 shows evidence of deterioration of factory-applied finishes within specified warranty period.

- 15 1. Deterioration includes, but is not limited to, the following:  
16 a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.  
17 b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.  
18 c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.  
19 2. Warranty Period: 10 years from date of Substantial Completion.

20 PART 2 - PRODUCTS

21 2.1 MANUFACTURED CANOPY

- 22 A. Provide cantilevered, manufactured canopy with finished fascia and concealed drainage.

- 23 B. Basis-of-Design Product: Subject to compliance with requirements, provide Super Lumideck, Mapes  
24 Canopies, Lincoln, Nebraska or comparable products by one of the following:

- 25 a. MASA Architectural Canopies: Extrudeck Aluminum Sunshade System.

- 26 C. Profile Characteristics:

- 27 1. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and  
28 thickness shown in current Mapes brochures.  
29 2. 36 inch and 60 inch deep canopies with cantilevered supports.  
30 3. Fascia:  
31 a. Profile: 8" J  
32 b. Thickness: .125" thick  
33 4. Deflection Rating: L/180

## 2.2 SUN CONTROL DEVICE

- A. Provide cantilevered, sun control device with finished fascia and fixed louvers.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Supershade, Mapes Canopies, Lincoln, Nebraska or comparable products by one of the following:
  - a. MASA Architectural Canopies: Ecoshade Aluminum Sunshade System.
- C. Profile Characteristics:
  - 1. Extruded Aluminum (T6-6063)
  - 2. 36 inch deep with cantilevered supports.
  - 3. Fascia:
    - a. Profile: 8" J
    - b. Thickness: .125" thick
  - 4. Louvers: .110" thick
  - 5. Deflection Rating: L/180

## 2.3 FABRICATION

- A. General: Fabricate to provide a complete system for assembly of components and anchorage of cantilevered canopies.
- B. All Mapes extruded aluminum canopies are shipped with the materials precut to size for field assembly.
- C. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
- D. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Front Scupper.

## 2.4 ALUMINUM FINISHES

- A. Two-coat, 70% fluoropolymer finish complying with AAMA 2605. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cantilevered canopies.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before cantilevered canopy installation.
- C. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.

- 1 D. Proceed with installation only after unsatisfactory conditions have been corrected.
- 2 1. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and
- 3 roofing in the area is complete.
- 4 3.2 PREPARATION
- 5 A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other anchors.
- 6 1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of
- 7 time needed for coordinating other work.
- 8 3.3 INSTALLATION
- 9 A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be
- 10 given to protecting the finish during handling and erection.
- 11 3.4 CLEANING AND PROTECTION
- 12 A. Clean surfaces promptly after installation of cantilevered canopies. Take care to avoid damaging the
- 13 finish.
- 14 END OF SECTION 107310

SECTION 111916 - DETENTION GUN LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Pistol lockers.

- B. Related Requirements:

1. Section 125500 "Detention Furniture" for detention furniture.

1.3 COORDINATION

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

- B. Coordinate size and location of recesses in wall construction to receive recessed detention gun lockers.

1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for detention gun lockers.

- B. Shop Drawings: For detention gun lockers.

1. Include plans, elevations, sections, and attachment details.  
2. Indicate locations, dimensions, and profiles of wall and floor reinforcements.  
3. Indicate locations and installation details of built-in anchors.  
4. Show elevations and indicate dimensions of detention gun lockers, preparations for receiving anchors, and locations of anchorage.  
5. Show details of attachment of detention gun lockers to built-in anchors.

- C. Samples for Initial Selection: For detention gun lockers with factory-applied color finishes.

## 1.5 QUALITY ASSURANCE

## A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

## 1.6 FIELD CONDITIONS

## A. Field Measurements: Verify openings for recessed detention gun lockers by field measurements before fabrication.

## PART 2 - PRODUCTS

## 2.1 PISTOL LOCKERS

## A. Basis-of-Design Product: Subject to compliance with requirements, provide Steele Solutions Tiffin Sidearm Locker Model No. WLK24061806KNAA – recess mount, or comparable products by one of the following manufacturers:

1. Southwest Solutions Group, Inc.: Model No. HGF 06
2. Spacesaver Corporation: Model No. EDHGF06

## B. Cabinet: Minimum 29 inches wide by 22 inches high by 9 inches deep. Line each compartment with mothproofed felt or nonabsorbing, closed-cell padding.

1. Compartments: Six.

## C. Doors: Formed from 0.0635-inch nominal-thickness steel sheet, supported by heavy-duty continuous bottom hinge.

## D. Locks: Cylinder type, keyed differently and master keyed; provide one lock for each compartment.

## E. Mounting: Recessed, with mounting flange formed from same material as body.

## F. Materials:

1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, CS (Commercial Steel), Type B; suitable for exposed applications.
3. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.

## G. Finishes:

1. Steel Baked-Enamel or Powder-Coat Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

- a. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.2 FABRICATION

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Coordinate dimensions and attachment methods of detention gun lockers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Shear and punch metals cleanly and accurately. Remove burrs.
- D. Form and grind edges and corners to be free of sharp edges or rough areas.
- E. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- F. Weld corners and seams continuously to comply with referenced AWS standard and the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish exposed welds and surfaces smooth and blended at exposed connections, so that no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
  5. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- G. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure detention gun lockers rigidly in place and to support expected loads. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce formed-metal units as needed to attach and support other construction.
- H. Cut, reinforce, drill, and tap detention gun lockers as indicated to receive hardware, fasteners, and similar items.
- I. Form exposed work true to line and level with accurate angles, surfaces, and straight sharp edges.
- J. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

## 2.3 ACCESSORIES

- A. Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.
- B. Cast-in-Place Anchors in Concrete: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to [4] <Insert safety factor> times the load imposed, as determined by testing according to ASTM E488/E488M, conducted by a qualified testing agency; of type indicated below.
1. Threaded or wedge type; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed; hot-dip galvanized according to ASTM A153/A153M or ASTM F2329/F2329M.



- 1 C. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum 3/16 inch (4.8 mm)  
2 thick; with minimum 1/2-inch- (12.7-mm-) diameter, headed studs welded to back of plate.
- 3 D. Proprietary Built-in Masonry Anchors: Fabricated from [0.134-inch (3.42-mm) nominal-thickness steel  
4 sheet] [1/4-inch (6-mm) nominal-thickness steel plate] [1/2-inch (12.7-mm) nominal-thickness steel plate]  
5 into [6-inch- (152-mm-)] [8-inch- (203-mm-)] deep blocks matching size of concrete masonry units[; with  
6 weld nuts attached on inside to receive field-bolted attachments].
- 7 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>  
8 2. Finish: [Factory primed for field painting for anchors with field-welded attachments] [Polyester  
9 powder coat for anchors with bolted attachments] [Epoxy paint for anchors with bolted  
10 attachments].
- 11 E. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

## 12 PART 3 - EXECUTION

### 13 3.1 EXAMINATION

- 14 A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for  
15 installation tolerances and other conditions affecting performance of detention gun lockers.
- 16 B. Examine roughing-in for embedded and built-in anchors to verify actual locations of detention gun  
17 lockers before detention gun locker installation.
- 18 C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of detention  
19 gun lockers.
- 20 D. Inspect built-in and cast-in anchor installations, before installing detention gun lockers, to verify that  
21 anchor installations comply with requirements. Prepare inspection reports.
- 22 1. Remove and replace anchors where inspections indicate that they do not comply with specified  
23 requirements. Reinspect after repairs or replacements are made.
- 24 2. Perform additional inspections to determine compliance of replaced or additional work. Prepare  
25 inspection reports.
- 26 E. Verify locations of detention gun lockers with those indicated on Shop Drawings.
- 27 F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 28 3.2 INSTALLATION

- 29 A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for  
30 securing detention gun lockers to in-place construction. Include threaded fasteners for [concrete] [and]  
31 [masonry] inserts and other connectors.
- 32 B. Cutting, Fitting, and Placement: Obtain manufacturer's written approval for cutting, drilling, and fitting  
33 required for installing detention gun lockers. Set detention gun lockers accurately in location, alignment,  
34 and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established  
35 lines and levels.

- 1 C. Provide temporary bracing or anchors in formwork for items that are to be built into [concrete] [or]  
2 [masonry] or similar construction.
- 3 D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be  
4 left as exposed joints but cannot be shop welded because of shipping size limitations.
- 5 E. Adjust doors and latches of detention gun lockers to operate easily without binding. Verify that integral  
6 locking devices operate properly.
- 7 F. Assemble detention gun lockers requiring field assembly with security fasteners with no exposed  
8 fasteners on exposed faces and frames.

9 3.3 FIELD QUALITY CONTROL

- 10 A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate  
11 compliance with and deviations from the Contract Documents.
- 12 B. Remove and replace detention work if inspections indicate that work does not comply with specified  
13 requirements. Remove malfunctioning units; replace with new units.
- 14 C. Perform additional inspections to determine compliance of replaced or additional work. Prepare  
15 inspection reports.

16 END OF SECTION 111916

1 SECTION 115313 - LABORATORY FUME HOODS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Bench-top laboratory fume hoods.  
9 2. Piping and wiring within fume hoods for service fittings, light fixtures, fan switches, and other  
10 electrical devices included with fume hoods.

- 11 B. Related Requirements:

- 12 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for field quality-control testing of  
13 fume hoods.

14 1.3 COORDINATION

- 15 A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.

- 16 B. Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

17 1.4 ACTION SUBMITTALS

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

- 19 B. Shop Drawings: For laboratory fume hoods.

- 20 1. Include plans, elevations, sections, and attachment details.  
21 2. Indicate details for anchoring fume hoods to permanent building construction including locations  
22 of blocking and other supports.  
23 3. Indicate locations and types of service fittings together with associated service supply connection  
24 required.  
25 4. Indicate duct connections, electrical connections, and locations of access panels.  
26 5. Include roughing-in information for mechanical, plumbing, and electrical connections.  
27 6. Show adjacent walls, doors, windows, other building components, laboratory casework, and other  
28 laboratory equipment. Indicate clearances from the above items.

29 1.5 MAINTENANCE MATERIAL SUBMITTALS

- 30 A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers,  
31 primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

## 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Constant Volume Fume Hoods with Non-metallic Exterior:

1. Basis of Design Manufacturer: Subject to compliance with requirements HEMCO Corporation; 711 S. Powell Road, Independence, MO 64056; Web: hemcocorp.com

2. Provide basis of design product or comparable product approved by Architect prior to bid.

- A. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods - Recommended Practices. Provide fume hoods UL listed and labeled for compliance with UL 1805.

- B. Product Designations: Drawings indicate sizes, types, and configurations of fume hoods by referencing designated manufacturer's catalog numbers. Other manufacturers' fume hoods of similar sizes, types, and configurations, and complying with the Specifications, may be considered. See Section 016000 "Product Requirements."

## 2.2 FUME HOODS

- A. Bench-Top Fume Hood:

a. Basis-of-Design Product: Subject to compliance with requirements, provide HEMCO Corporation; UniFlow CE AireStream CAV Hood with Vapor Proof Light Catalog No. 14841 or comparable products by one of the following manufacturers:

- 1) Fisher American.
- 2) Labconco.

2. Size:

- a. Width: 48 inches.
- b. Height: 45 inches.
- c. Depth: 24 inches.

## 2.3 MATERIALS

- A. Molded: reinforced HiPel® (Two (2) white surfaces chemically bonded to a fiberglass reinforced core layer of Hipel® thermosetting resin. No exposed fiberglass. Nominal thickness of 4.5mm). Hipel® meets or exceeds the NFPA 45 Fire Protection for Laboratories using Chemicals. (UL 1805 Classified).
1. 3/16"-1/4" thick HiPel® composite resin. Double wall shall provide base for remote service fixture outlets, electrical boxes and other service that may be required.
- B. Glass: Clear, laminated tempered glass complying with ASTM C1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with clear, polyvinyl butyral interlayer.
1. 1/4" Laminated Safety Glass
2. Permanently mark safety glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Fasteners: Provide stainless steel fasteners where exposed to fumes.

## 2.4 FABRICATION

- A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 34-by-83-inch door opening.
- B. Unitized Superstructure: Consists of 3/16" thick, non-conducting, dual wall HiPel® composite resin side walls, 5" side wall width. Exterior side walls are chemically bonded to a molded liner so that the complete structure is composite unitized construction. Any framing not consisting of a complete fiberglass structure is unacceptable. Front and both sides of the superstructure are aligned for precision fit.
- C. Airfoils:
1. Lower airfoil: Molded of non-conducting HiPel® composite resin. Airfoil across lower sash to provide clean sweep of air over work surface. One inch air bypass inlet under air foil to ensure uniform air flow at the face of the fume hood. Sweeps heavier than air vapors off work surface.
2. Upper Airfoil: Molded of non-conducting HiPel® composite resin, that provides clean flow of air in upper area of the fume chamber to minimize turbulent air flow through the fume chamber.
- D. Sash Assembly:
1. Full view vertical raising clear tempered safety glass framed in solid white PVC framing. The sash shall have full width finger sash pull; to have "trailing edge" to prevent back flow of 11610.1- 4 fumes to escape fume chamber. The sash shall be counter balanced at a single point to eliminate racking of the sash. Sash shall require no more than a 5 pound force to lift. 1/8" diameter stainless steel aircraft cable connects the sash to the epoxy coated counterweight. Cable to have PVC coating to prevent corrosion. The cable rides on a 2" diameter nylon ball bearing pulley system. Sash cable to run through the bottom of the sash to prevent sash from dropping. Equipped with an adjustable counterweight for tilting adjustment. Pulley bearings stainless steel. Painted steel parts in the sash are not acceptable.
- E. VaraFlow Baffles: The fume hood superstructure shall have an internal baffle system of the same HiPel® composite material as the hood structure. Lower baffle shall consist of a staggered slotted array for near laminar air flow through fume chamber. The baffle system shall provide for safe efficient removal of

fumes through the fume chamber. Baffles to have rounded entry edges to draw fumes smooth through baffle system. Baffles are removable for cleaning. Constructed of non conducting, HiPel® composite resin.

F. Extended View Panel: Sash is extended taller to systems consisting of a 3/16" thick clear tempered safety glass panel allowing full visual display of fume hood interior.

G. Duct collars: standard round exhaust outlet collar(s), bell entry from fume chamber to efficiently draw fumes into exhaust duct. The outlet to be constructed of the same material as the hood structure (HiPel® composite resin) and chemically bonded to the fume chamber ceiling. Metal screws, bolts or welds are not acceptable for attaching. 30" hood ( 1-6" dia), 36" hood ( 1-6" dia), 48" hood (1-8" dia), 72" hood (1-10" dia).

H. Fascia posts: Aerodynamically angled to provide uniform air flow into the fume chamber. Shall be a continuation of the one piece homogeneous liner. Molded of non-conducting HiPel® composite resin.

I. Exterior Side Panels: Molded of non-conducting HiPel® composite resin. Unitized and chemically bonded to form homogeneous one piece superstructure. Painted steel end panels not acceptable.

J. Clearance (interior): All CE hoods are designed to have a nominal interior vertical clearance of 35" in the front twelve inches of the hood depth. Dimensions of the interior may be affected by additional services or options.

K. Lighting: Vapor proof light fixture consist of screw in bulb fixture with gasket threaded glass globe.  
1. Hinged light fixture configured for (2) 3000K linear T-5 fluorescent lamps installed on the exterior of the fume hood roof. Light brackets constructed of stainless steel with a mirrored interior finish for maximum reflectivity. Painted steel brackets are not acceptable. A clear tempered safety glass panel is provided as a vapor-tight barrier and seal to separate the fluorescent fixture from the hood interior. Fluorescent fixtures are UL listed and CSA listed. Fluorescent T-5 tubes provided with fixture. (115V/60Hz or 220V/50 Hz available) (UL 1805 Classified).

L. Service Fittings and Fixtures:

1. Service fittings and fixtures shall be manufactured by the Water Saver Fixture Company or equal equivalent. Fixtures and handles shall indicate the proper service using color coding.
2. Finish of Service Fixtures: a. Laboratory service fixtures (with the exception of fittings inside the fume hood) shall have (Option – choose one):
  - a. A forged brass polished handle with a full-view screw-on colored index button. (optional)
  - b. Service fittings inside the hood shall have an epoxy finish color that is coded to match the fixture service index color.

M. Electrical services:

1. All electrical receptacles, duplexes, and switches are prewired to a single junction box for electrical connection (with the exception of explosion proof models). All electrical receptacles are 3-wire, 15 or 20 amp duplex, 115 or 230 VAC, or as specified. Light switch shall be 3-wire polarized grounded, 15 amp, 125VAC or as specified. Face plates are nylon. Electrical components are UL/CSA listed.

N. Work surfaces:

1. Composite resin, 1-1/4" thick, molded to contain chemical spillage, dished section not less than 1/4" thick. Gray

O. Instruction Plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information covering recommended locations for apparatus and accessories, use of sash and recommended safe operating procedures.

## 2.5 CHEMICAL-RESISTANT FINISH

- A. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.
- B. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8M. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
  2. Colors for Fume Hood Finish: As indicated by manufacturer's designations.

## 2.6 SOURCE QUALITY CONTROL

- A. Demonstrate fume hood performance before shipment by testing fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article. Provide testing facility, instruments, equipment, and materials needed for tests.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

## 3.3 FIELD QUALITY CONTROL

- A. Field test installed fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article to verify compliance with performance requirements.
1. Adjust fume hoods, hood exhaust fans, and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.
  2. After making corrections, retest fume hoods that failed to perform as specified.

- 1 3.4 ADJUSTING AND CLEANING
- 2 A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for
- 3 uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- 4 B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish
- 5 damaged or soiled areas to match original factory finish, as approved by Architect.
- 6 END OF SECTION 115313



1 SECTION 142400 - HYDRAULIC ELEVATORS

2 PART 1 - GENERAL

3 1.1 SUMMARY

- 4 A. Section includes hydraulic passenger elevators.

5 1.2 ACTION SUBMITTALS

- 6 A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar  
7 information.

- 8 B. Shop Drawings:

- 9 1. Include plans, elevations, sections, and large-scale details indicating service at each landing;  
10 machine room layout; coordination with building structure; relationships with other construction;  
11 and locations of equipment.  
12 2. Indicate maximum dynamic and static loads imposed on building structure at points of support as  
13 well as maximum and average power demands.

- 14 C. Samples: For finishes involving color selection.

15 1.3 INFORMATIONAL SUBMITTALS

- 16 A. Manufacturer Certificates: Signed by elevator manufacturer, certifying that hoistway, pit, and machine  
17 room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are  
18 adequate for elevator system being provided.

19 1.4 CLOSEOUT SUBMITTALS

- 20 A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance  
21 manuals.

- 22 B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having  
23 jurisdiction for normal, unrestricted elevator use.

- 24 C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in  
25 the form of a standard two-year maintenance agreement, starting on date initial maintenance service is  
26 concluded. State services, obligations, conditions, and terms for agreement period and for future renewal  
27 options.

28 1.5 WARRANTY

- 29 A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that  
30 fails in materials or workmanship within specified warranty period.

- 31 1. Warranty Period: Five (5) year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 HYDRAULIC ELEVATOR MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Otis HydroFit 2510 Passenger as manufactured by Otis Elevator Company, a United Technologies Company, or comparable product by one of the following:

1. Schindler Elevator Corp.
2. Thyssen Elevator Group North America.

- B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

- B. Accessibility Requirements: Comply with Section 407 in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

## 2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

- B. Elevator Description:

1. Type: Holeless, beside-the-car, single-acting, dual cylinder.
2. Rated Load: 2500 lb (1135 kg).
3. Rated Speed: 100 fpm (0.51 m/s).
4. Operation System: Single automatic operation.
5. Auxiliary Operations:
  - a. Battery-powered lowering.
  - b. Automatic dispatching of loaded car.
  - c. Nuisance call cancel.
  - d. Automatic operation of lights and ventilation fans.

6. Security Features: Keyswitch operation.

7. Car Enclosures:

- a. Inside Width: Not less than 78 inches from side wall to side wall.
- b. Inside Depth: Not less than 52 inches from back wall to front wall (return panels).
- c. Inside Height: Not less than 93 inches (2362 mm) to underside of ceiling.
- d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
- e. Car Fixtures: Satin stainless steel, No. 4 finish.
- f. Side and Rear Wall Panels: Enameled steel shell cab with raised laminate wall panels and brushed stainless steel finished vertical trim pieces between panels.
- g. Door Faces (Interior): Satin stainless steel, No. 4 finish.

- 1 h. Door Sills: Aluminum.  
2 i. Ceiling: LED Perimeter Lit Ceiling; Satin stainless steel, No. 4 finish.  
3 j. Handrails: 1/2 by 2 inches rectangular satin stainless steel, No. 4 finish at sides and rear of  
4 car.  
5 k. Floor prepared to receive luxury vinyl tile (LVT) as scheduled on drawings.
- 6 8. Hoistway Entrances:
- 7 a. Width: 42 inches.  
8 b. Height: 84 inches.  
9 c. Type: Single-speed side sliding.  
10 d. Frames: Satin stainless steel, No. 4 finish.  
11 e. Doors: Satin stainless steel, No. 4 finish.
- 12 9. Hall Fixtures: Satin stainless steel, No. 4 finish.  
13 10. Additional Requirements:
- 14 a. Provide inspection certificate in each car, mounted under acrylic cover with frame made  
15 from satin stainless steel, No. 4 finish.  
16 b. Provide hooks for protective pads and one (1) complete set of full-height protective pads.
- 17 2.4 SYSTEMS AND COMPONENTS
- 18 A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and  
19 full load and with minimum pulsations.
- 20 1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be  
21 suspended inside oil tank from vibration isolation mounts.  
22 2. Motor shall have wye-delta or solid-state starting.  
23 3. Motor shall have variable-voltage, variable-frequency control.
- 24 B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in  
25 blowout-proof housing at pump unit.
- 26 C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible  
27 connectors to minimize sound and vibration transmissions from power unit.
- 28 1. Cylinder units shall be connected with dielectric couplings.  
29 2. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D1785, joined  
30 with PVC fittings complying with ASTM D2466 and solvent cement complying with  
31 ASTM D2564.
- 32 D. Hydraulic Fluid: Elevator manufacturer's standard fire-resistant fluid with additives as needed to prevent  
33 oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.
- 34 E. Guides: Polymer-coated, nonlubricated sliding guides or sliding guides with guide-rail lubricators.  
35 Provide guides at top and bottom of car frame.
- 36 2.5 OPERATION SYSTEMS
- 37 A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of  
38 operation indicated.

B. Auxiliary Operations:

1. Single-Car Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
2. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after 5 minutes and are re-energized before car doors open.

C. Security Features: Security features shall not affect emergency firefighters' service.

1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations.

2.6 DOOR-REOPENING DEVICES

A. Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door-reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

A. General: Provide enameled- or powder-coated-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor:
  - a. Exterior, underlayment-grade plywood, not less than 5/8-inch nominal thickness
2. Enameled- or Powder-Coated-Steel Wall Panels: Flush, formed-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel or powder-coat finish; colors as selected by Architect from manufacturer's full range.
3. Raised Plastic-Laminate Wall Panels: Manufacturer's standard plastic-laminate panel construction. Plastic-laminate color, texture, and pattern as selected by Architect from elevator manufacturer's full range.
4. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
5. Sight Guards: Provide sight guards on car doors.
6. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
7. LED Perimeter Lit Ceiling: Stainless steel ceiling panels. Flush, formed-metal construction; fabricated from stainless-steel sheet. Align ceiling panel joints with joints between wall panels.
8. Light Fixture Efficiency: Not less than 35 lumens/W.
9. Ventilation Fan Efficiency: Not less than 3.0 cfm/W (1.4 L/s per W).

## 2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door-and-frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
1. Stainless-Steel Frames: Formed from stainless-steel sheet.
  2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel.
  3. Sight Guards: Provide sight guards on doors matching door edges.
  4. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
  5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

## 2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
1. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 283000 "Fire Alarm and Detection System – Addressable Speaker".
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide hall push-button station at each landing.
- G. Hall Lanterns: Units with illuminated arrows; however, provide single arrow at terminal landings. Provide the following:
1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

I. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide illuminated signal that indicates when normal power supply has failed.

J. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

## 2.10 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.

C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304.

D. Stainless-Steel Bars: ASTM A276, Type 304.

E. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063.

F. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS or Type HGL.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

B. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

C. Lubricate operating parts of systems as recommended by manufacturers.

D. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and travel direction.

E. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

F. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

## 3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

## 3.3 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes. Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
3. Engage elevator Installer to provide full maintenance service.
4. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

## 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

## 3.5 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include twelve months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

END OF SECTION 142400

**DIVISION 21 – FIRE SUPPRESSION****SECTION 21 05 00 - STANDARD CONDITIONS FOR FIRE SUPPRESSION****PART 1 - GENERAL****1.01 REFERENCE**

- A. Requirements established within the portions of this project manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and addenda as issued are part of this specification.
- C. Plumbing/Fire Suppression drawings along with all other project drawings and specifications represent the work of this section.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

**1.02 SCOPE**

- A. Provide labor, material, equipment, and supervision necessary to install complete operating fire suppression systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.
- B. It shall be the contractor's responsibility to coordinate his work and the work of his subcontractors to ensure that all the work is covered. He shall designate who is responsible for various portions of work which may overlap so that there is complete coverage of all required work. It is the position of the owner and the A/E that all work is the responsibility of the mechanical contractor within this Division of the work.
- C. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
- D. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- E. It shall be the fire suppression contractor's responsibility to develop the design of the system based on current flow test results and to provide all the documentation necessary for final approval.
- F. Fire suppression contractor's scope of work shall include but not be limited to the following:
  - 1. Wet Sprinkler System, Siamese connection.

**1.03 REGULATIONS, CODES, AND STANDARDS**

- A. Work shall be performed in accordance with the latest adopted codes, amendments, regulations, and ordinances of the authorities having jurisdiction. Observe all safety regulations including the requirements of OSHA.
- B. Obtain and pay for all permits, connection charges, inspections, and certificates required to



- complete the work.
- C. Latest editions of any referenced standards shall govern.
- D. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

#### 1.04 SUBMISSIONS

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A/E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
- D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
- E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- F. Contractor to forward a copy of submittals which have electrical requirements to the Electrical Contractor (EC) for coordination of voltage, amperage, and phase. Response to be received from EC prior to ordering of equipment by mechanical contractor.
- G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items and equipment shall be combined in a single brochure with all items being furnished clearly identified.
- H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and coordinated with all other trades.
- I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.
- J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.
- K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150/hr billable to the contractor.

#### 1.05 SITE INSPECTION

- A. Visit site, inspect, and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of bid will be deemed evidence of having complied with this request. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.

#### 1.06 SUBSTITUTIONS

- A. Material and equipment specified shall be deemed as that which the bidder's quotation represents.
- B. Once bids are accepted only that material and equipment listed in the specifications or added by addenda shall be acceptable. Substitution information for inclusion in an addenda must be received by the A/E at least 10 days prior to bid opening. If acceptable, an addenda will be issued which will add the additional acceptable manufacturers or materials and be available for all contractors to consider. A contractor cannot be the lowest bidder because he utilized substituted materials or equipment as opposed to specified materials or equipment.
- C. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of \$150.00/hr. for such services. Also billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval or rejection.
- D. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

#### 1.07 DRAWINGS AND SPECIFICATIONS

- A. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.
- B. When a conflict or contradiction exists either between drawings and specs or between specs or between different drawings or details, the more stringent shall apply.
- C. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- D. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.
- E. The contractor shall refer to the drawings for details which may influence the design of the fire suppression systems.
- F. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding.

and an answer shall be issued as an addendum to all bidders.

- G. If a question arises after bidding the A/E interpretation shall govern.

#### 1.08 MEASUREMENTS

- A. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

#### 1.09 PROGRESS SCHEDULE

- A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date. Work involving interruption of services shall be clearly designated and approved.

#### 1.10 COST SCHEDULE

- A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.  
B. AIA forms are required for this submission.

#### 1.11 COMPLETION

- A. The contractor shall deliver to the owner, with his request for final payment, copies of all manufacturer's guarantees, equipment instructional manuals, a complete set of all final shop drawings, catalog cuts, service contracts, and other items as may be required elsewhere in the documents.

#### 1.12 OFFICE

- A. The contractor shall set up his job office (desk) where directed by the owner.

#### 1.13 STORAGE

- A. Material shall be stored only where directed by the owner.

#### 1.14 SANITARY

- A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.  
B. Toilet will be located where directed by the owner.

### **PART 2 - PRODUCTS**

#### 2.01 GENERAL

- A. All material shall be new and of present day manufacture.  
B. All material and equipment shall be in conformance with accepted trade standards.  
C. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed to apply to as many such items as may be necessary to complete the installation.  
D. The word "provide" means "furnish and install complete, tested, and adjusted as necessary

with all accessories, covers, escutcheons". The word "piping" means pipe, fitting, controls, valves, and hangers as required for a complete system.

## 2.02 EQUIPMENT START UP

- A. Verify that equipment is operating within warranty requirements.
- B. Advise owner and A/E at least two days prior.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to A/E.
- D. Fire pump operation and testing to conform to applicable NFPA requirements.

## 2.03 LUBRICATION

- A. Lubricate all equipment in accordance with manufacturer's instructions.
- B. Lubricate prior to start up.
- C. Provide one year's supply of lubricants to the owner.

## 2.04 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner's personnel in the operation and maintenance of all systems and equipment.
- B. Ensure that the owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each system as a whole.
- D. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, control sequences, service requirements, piping diagrams, names, and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
- E. Provide to the owner any special tools necessary to operate any of the equipment.

# PART 3 - EXECUTION

## 3.01 PROTECTION

- A. Plug or cap open ends of piping systems.
- B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
- C. Protect all installed work until accepted in place by the owner.
- D. Do not install sprinklers, polished metal escutcheons, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
- E. Protect all existing or new work from operations which may cause damage such as hauling, welding, and painting.

## 3.02 WORKMANSHIP

- A. Install all work neat, trim, and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

**3.03 EXCAVATION, SHORING, PUMPING, BACKFILLING**

- A. Perform all excavation required to install the work. Deposit excavated material so as not to create a slide hazard.
- B. No work shall be placed on rock. Cushion with 6 " layer of crushed stone.
- C. Protect tree roots with burlap covering and maintain moist until backfilled.
- D. Base estimates on excavation which will include earth, sand, clay, rubbish, debris, and all other materials up to one cubic yard in size. Boulders or rock larger than one cubic yard which need to be broken up with pneumatic equipment or explosives will be separately negotiated at the time of discovery with the owner and A/E. Do not proceed with rock excavation until an agreement is reached.
- E. Maintain excavations free of water.
- F. Shore excavations to prevent cave-in in accordance with OSHA regulations and to prevent strains on work put in place until ready to receive backfill.
- G. Backfill with clean material and pneumatically tamp in 8" layers. Remove excess material, including rock, from site or as directed by the A/E.
- H. Backfill piping trenches within 18" of footings, columns, piers, or grade beams, with concrete. Protect piping from direct contact and adherence to concrete.
- I. Return to original condition any areas disturbed for excavation.
- J. Provide pipe restraints as specified.

**3.04 FASTENERS, HANGERS, AND SUPPORTS**

- A. Furnish and install all hangers and supports required to suspend, mount, or hang the work per NFPA requirements.
- B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets, and anchors to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded to more than 1/4 rated capacity with a minimum of 200 lbs.
- E. Power driven fasteners shall not be allowed for piping larger than 2", or for equipment. When used they shall not be loaded more than 1/8 rated capacity with a minimum of 200 lbs.
- F. Provide seismic restraint for piping as required by NFPA.

**3.05 OFFSETS, TRANSITIONS, MODIFICATIONS**

- A. Furnish and install all offsets necessary to install the work and to provide clearance for the other trades.
- B. Maintain adequate headroom and clearance as directed by the A/E.
- C. Incidental modifications necessary to the installation of the systems shall be made as necessary and at the direction of the A/E.
- D. Rises and drops of piping systems shall be provided as required and where directed to allow for clearances to other construction. Drains shall be installed at no additional cost to the owner. The contractor shall allow for such occurrences in his bid.
- E. Piping, and equipment shall be so arranged as to not pass in front of windows, doors, access panels, access doors, and service clearance areas. Do not install within 3'-0" clearance of electrical or panel fronts.

**3.06 EQUIPMENT SETTING**

- A. Furnish and install as a minimum, a concrete pad beneath all floor mounted equipment in mechanical rooms or equipment rooms.
- B. Reinforce concrete with No. 4 rods 12" on centers both ways.

- C. Pad to have 3/4" dowels into concrete at 1 per 4 square feet.

### 3.07 ACCESS

- A. Locate all equipment, valves, devices, and controllers which may need service in accessible places.

### 3.08 WIRING

- A. Power wiring shall be provided by the Division 26 Electrical Contractor. This contractor shall furnish all controllers necessary to operate the equipment. The Electrical Contractor shall store and install the electrical devices and furnish and install the power wiring.
- B. Supervisory and alarm wiring shall be furnished and installed under Division 28 portion of the work.
- C. All wiring shall be in accordance with the NEC.
- D. Pushbuttons shall be maintain-contact type.
- E. Refer to the electrical specifications for wiring methods.
- F. Plenum rated cable is required for control wiring.

### 3.09 UTILITIES

- A. Do not interrupt any utility or service without adequate previous notice and scheduling with the owner.
- B. Refer to Division 1 for requirements for providing temporary utilities.

### 3.10 CUTTING AND PATCHING EXTERIOR SERVICES

- A. This contractor shall be responsible for returning disturbed areas to original condition where excavation for utilities has been required.
- B. Cut and patch paved areas to match original surfaces.
- C. Properly tamp backfill before finishing surfaces.
- D. Concrete pavements and curbs shall be formed and poured to match adjacent areas.
- E. Grass areas shall be sodded and maintained until established growth is achieved.

### 3.11 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the owner unless otherwise specified. Material and labor for first year warranty is to be provided.
- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.

### 3.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver material and equipment in manufacturer's original cartons or on skids.
- B. Store material in dry enclosures or under protective coverings out of way of work progress.
- C. Handle so as to prevent damage to product or any surrounding material.

### 3.13 MANUFACTURER'S NAMES

- A. Manufacturers names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. All material and

equipment must be U.L. and FM approved. Any deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.

### 3.14 AS-BUILT DRAWINGS

- A. At the completion of the work the contractor shall furnish a reproducible as-built drawings to the A/E for approval. The drawings shall indicate all work installed and its actual size and location. If acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
- C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150/hr. billable to the contractor.

### 3.15 PENETRATION SEALING

- A. All penetrations of fire walls, smoke walls, and floors by ducts, pipes, conduit, or wiring shall be sealed to prevent the flow of gasses or smoke.
- B. The sealant shall be foamed in place between the penetrant and the adjacent floor or wall with DOW Corning RTV foam or equivalent by 3M, Hilti, or Chase foam.
- C. The installation shall meet the approval of the authority having jurisdiction.
- D. Penetrations through rated surfaces shall have a UL rating equivalent to the adjacent surfaces.

### 3.16 CUTTING AND PATCHING INTERIOR SURFACES

- A. Respective contractor shall install all hangers, supports, pipe sleeves in floors, walls, partitions, ceilings, and roof slabs as construction progresses to permit their work to be built into place and to eliminate unnecessary cutting of construction work.
- B. All cutting of concrete, or other material for the passage of piping through floors, walls, partitions, and ceiling shall be done by the contractor where necessary to install his work. Contractor will close all such openings around piping, and conduit with materials equivalent to that removed. All exposed surfaces shall be left in suitable condition for refinishing without further work.
- C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

### 3.17 COORDINATION

- A. The sprinkler shop drawings shall show all ductwork, diffusers, grilles, piping, conduit lighting fixtures coordinated with the sprinkler piping and sprinkler beads.
- B. All architectural features, structural conditions which may impact on the sprinkler layout shall be shown.
- C. The location of equipment, controller, fire pumps, and jockey pumps compression and valve shall be coordinated with the other trades showing all necessary clearances.

**3.18 WELDING**

- A. All electric power for arc welding shall be supplied by the contractor performing the work.

**3.19 VEHICLES**

- A. Vehicle access to the site will be as directed by the owner.

**3.20 RUBBISH DISPOSAL**

- A. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

**3.21 PROTECTION**

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.

**3.22 SCAFFOLDING**

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

**3.23 CLEANUP**

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from equipment.
- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Remove all trash and debris from the premises.

**3.24 WORK COMPLETION**

- A. The contractor shall promptly correct work rejected by the engineer failing to conform to the requirements of the contract documents, whether discovered before or after substantial completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

**3.25 REQUEST FOR INFORMATION (RFI) REQUIREMENTS**

- A. All RFI's shall include the following information based on AIA Document G716:
  - 1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
  - 2. Provide a description with specification and/or drawing references.
  - 3. Provide the senders recommendation including cost and/or schedule considerations.
  - 4. Provide receiver's reply space.
  - 5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

**3.26 SHOP DRAWING REQUIREMENTS**



- A. The following is a list of required shop drawings for the project. Not all items may be identified, and it is the responsibility of the contractor to submit additional shop drawings where indicated in the specifications.

<b>FIRE PROTECTION</b>	<b>DATE REC'D</b>	<b>ACTION</b>	<b>DATE REC'D</b>	<b>ACTION</b>
COORDINATION DRAWINGS				
SPRINKLER SYSTEM HYDRAULIC CALCULATIONS AND DESIGN DRAWINGS AND DETAILS				
FIRE MARSHAL APPROVAL				
INSURANCE COMPANY APPROVAL				
SPRINKLER HEADS				
PIPING/VALVES/HANGERS				
BACKFLOW PREVENTERS				
SPARE SPRINKLER CAP & SIGNS				
SIAMESE CONNECTION				
WATER MOTOR GONG				
FLOW & TAMPER SWITCHES				
AS-BUILTS				
WARRANTIES AND GUARANTEES				
OPERATIONS AND MAINTENANCE MANUALS				
TESTS/CERTIFICATIONS				
EMERGENCY AND MANUFACTURER CONTACTS				
CONTRACTOR'S LETTER OF COMPLETION				

END OF SECTION

**SECTION 21 05 13 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

**1.02 COORDINATION**

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.
  - 5. Fractional horsepower up to 1/2 HP; Electrical contract.
  - 6. Polyphase and single phase above 1/2 HP: This contract.

**PART 2 - PRODUCTS****2.01 GENERAL MOTOR REQUIREMENTS**

- A. Comply with NEMA MG 1 unless otherwise indicated.

**2.02 MOTOR CHARACTERISTICS**

- A. Duty: Continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

**2.03 POLYPHASE MOTORS**

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.

- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: [Class F] <Insert class>.
- I. Code Letter Designation:
  - 1. Motors [15] <Insert number> HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than [15] <Insert number> HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes [324T] <Insert number> and larger; rolled steel for motor frame sizes smaller than [324T] <Insert number>.

#### 2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: [Ratings, characteristics, and features coordinated with and approved by controller manufacturer.]
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

#### 2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

END OF SECTION

**SECTION 21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

**2.02 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. GPT; an EnPro Industries company.
  - 4. Metraflex Company (The).
  - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel or Plastic.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

**2.03 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.01 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in architectural specifications sections.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in architectural specifications sections.

### **3.02 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves or Galvanized-steel wall sleeves.

- b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves or Galvanized-steel wall sleeves.
- 2. Exterior Concrete Walls below Grade:
  - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
  - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6-inch: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6-inch and Larger: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
  - a. Piping Smaller Than NPS 6-inch: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6-inch and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

**SECTION 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 ESCUTCHEONS**

- A. One Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

**2.02 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast-iron flange [ with holes for fasteners].

**PART 3 - EXECUTION****3.01 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
  - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
  - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
  - h. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping: One-piece, floor-plate type.

### 3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION



**SECTION 21 05 23 - GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Iron butterfly valves with indicators.
  2. Check valves.
  3. Iron OS&Y gate valves.
  4. NRS gate valves.
  5. Indicator posts.
  6. Trim and drain valves.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
1. Main Level: HAMV - Fire Main Equipment.
    - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    - b. Level 1: HLOT - Valves.
      - 1) Level 3: HLUG - Ball Valves, System Control.
      - 2) Level 3: HLXS - Butterfly Valves.
      - 3) Level 3: HMER - Check Valves.
      - 4) Level 3: HMRZ - Gate Valves.
  2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
    - a. Level 1: VQGU - Valves, Trim and Drain.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
1. Automated Sprinkler Systems:
    - a. Indicator posts.
    - b. Valves.
      - 1) Gate valves.
      - 2) Check valves.
        - a. Single Check Valves
    - c. Miscellaneous valves.
- C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.
- D. ASME Compliance:
1. ASME B16.1 for flanges on iron valves.
  2. ASME B1.20.1 for threads for threaded-end valves.

- 3. ASME B31.9 for building services piping valves.
- E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- F. NFPA Compliance: Comply with NFPA 24 for valves.
- G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. Valve Actuator Types:
  - 1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
  - 2. Handwheel: For other than quarter-turn trim and drain valves.
  - 3. Handlever: For quarter-turn trim and drain valves NPS 2-inch and smaller.

## 2.02 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Globe Fire Sprinkler Corporation.
  - 2. NIBCO INC.
  - 3. Tyco Fire Products LP.
  - 4. Victaulic Company.
- B. Description:
  - 1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
  - 2. Minimum Pressure Rating: 175 psig.
  - 3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
  - 4. Seat Material: EPDM.
  - 5. Stem: Stainless steel.
  - 6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
  - 7. Actuator: Worm gear or traveling nut.
  - 8. Supervisory Switch: Internal or external.
  - 9. Body Design: Grooved-end connections.

## 2.03 CHECK VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Globe Fire Sprinkler Corporation.
  - 2. Mueller Co.
  - 3. NIBCO INC.
  - 4. Reliable Automatic Sprinkler Co., Inc. (The).
  - 5. Tyco Fire Products LP.
  - 6. Victaulic Company.
  - 7. Viking Corporation.
- B. Description:
  - 1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
  - 2. Minimum Pressure Rating: 175 psig.
  - 3. Type: Single swing check.
  - 4. Body Material: Cast iron, ductile iron, or bronze.
  - 5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
  - 6. Clapper Seat: Brass, bronze, or stainless steel.
  - 7. Hinge Shaft: Bronze or stainless steel.

8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

## 2.04 IRON OS&Y GATE VALVES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Hammond Valve.
  2. Mueller Co.
  3. NIBCO INC.
  4. Victaulic Company.
- B. Description:
1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
  2. Minimum Pressure Rating: 175 psig.
  3. Body and Bonnet Material: Cast or ductile iron.
  4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
  5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
  6. Stem: Brass or bronze.
  7. Packing: Non-asbestos PTFE.
  8. Supervisory Switch: External.
  9. End Connections: Grooved.

## 2.05 NRS GATE VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Mueller Co.
  2. NIBCO INC.
  3. Victaulic Company.
- B. Description:
1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
  2. Minimum Pressure Rating: 175 psig.
  3. Body and Bonnet Material: Cast or ductile iron.
  4. Wedge: Cast or ductile iron with elastomeric coating.
  5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
  6. Stem: Brass or bronze.
  7. Packing: Non-asbestos PTFE.
  8. Supervisory Switch: External.
  9. End Connections: Grooved.

## 2.06 INDICATOR POSTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Cast Iron Pipe Company.
  2. Clow Valve Company; a subsidiary of McWane, Inc.
  3. Kennedy Valve Company; a division of McWane, Inc.
  4. Mueller Co.
  5. NIBCO INC.
- B. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.
2. Type: Underground or Wall.
3. Base Barrel Material: Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.
6. Operation: Wrench or Handwheel.

## 2.07 TRIM AND DRAIN VALVES

### A. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fire Protection Products, Inc.
  - b. NIBCO INC.
  - c. United Brass Works, Inc.
2. Description:
  - a. Pressure Rating: 175 psig.
  - b. Body Material: Brass or bronze.
  - c. Ends: Threaded.
  - d. Stem: Bronze.
  - e. Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron, bronze, or aluminum.

## PART 3 - EXECUTION

### 3.01 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

- A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
  1. Section 211100 "Facility Fire Suppression Water-Service Piping" for application of valves in fire-suppression water service piping outside the building.
  2. Section 211200 "Fire Suppression Standpipes" for application of valves in fire-suppression standpipes.
  3. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
  4. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-

Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

- H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

END OF SECTION

**SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

**PART 2 - PRODUCTS****2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Brimar Industries, Inc.
    - c. Carlton Industries, LP.
    - d. Champion America.
    - e. Craftmark Pipe Markers.
    - f. emedco.
    - g. Kolbi Pipe Marker Co.
    - h. LEM Products Inc.
    - i. Marking Services, Inc.
    - j. Seton Identification Products.
  2. Material and Thickness: Brass, 0.032 inch, stainless steel, 0.025 inch, aluminum, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
  3. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
  4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two thirds to three fourths the size of principal lettering.
  5. Fasteners: Stainless-steel.
  6. Adhesive: Contact type permanent adhesive, compatible with label and with

substrate.

- B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8 ½ by 11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.02 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.
  - 2. Brimar Industries, Inc.
  - 3. Carlton Industries, LP.
  - 4. Champion America.
  - 5. Craftmark Pipe Markers.
  - 6. emedco.
  - 7. LEM Products Inc.
  - 8. Marking Services Inc.
  - 9. National Marker Company.
  - 10. Seton Identification Products.
  - 11. Stranco, Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
- C. Letter Color: Red.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by ¾ inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- H. Fasteners: Stainless steel.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.03 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
  - 2. Brady Corporation.
  - 3. Brimar Industries, Inc.
  - 4. Carlton Industries, LP.
  - 5. Champion America.
  - 6. Craftmark Pipe Markers.

7. emedco.
  8. Kolbi Pipe Marker Co.
  9. LEM Products Inc.
  10. Marking Services Inc.
  11. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-adhesive Pipe Labels: Printed plastic with contact type, permanent adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

#### **3.02 LABEL INSTALLATION REQUIREMENTS**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. Piping: Painting of piping is specified in Architectural Specification Sections or minimally (2) coats of exterior paint and (1) primer coat.
- F. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit a view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.



END OF SECTION

**SECTION 21 11 19 - FIRE-DEPARTMENT CONNECTIONS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Exposed type fire department connections.
  2. Flush type fire department connections.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire department connection.

**PART 2 - PRODUCTS****2.01 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Fire Hose & Cabinet.
  2. Elkhart Brass Mfg. Co., Inc.
  3. Fire Protection Products, Inc.
  4. Fire-End & Croker Corporation.
  5. Guardian Fire Equipment, Inc.
- B. Standard: UL 405.
- C. Type: Exposed, projecting, for wall mounting.
- D. Pressure Rating: 175 psig minimum.
- E. Body Material: Corrosion resistant metal.
- F. Inlets: Brass with threads according to NFPA 1963 and matching local fire department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
- G. Caps: Brass, lugged type, with gasket and chain.
- H. Escutcheon Plate: Round, brass, wall type.
- I. Outlet: Back, with pipe threads.
- J. Number of Inlets: Two.
- K. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."
- L. Outlet Size: NPS 4-inch.

**2.02 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION**

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

1. American Fire Hose & Cabinet.
  2. Elkhart Brass Mfg. Co., Inc.
  3. GMR International Equipment Corporation.
  4. Guardian Fire Equipment, Inc.
  5. Potter Roemer LLC.
  6. Venus Fire Protection Ltd.
- B. Standard: UL 405.
- C. Type: Flush, for wall mounting.
- D. Pressure Rating: 175 psig minimum.
- E. Body Material: Corrosion-resistant metal.
- F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
- G. Caps: Brass, lugged type, with gasket and chain.
- H. Escutcheon Plate: Rectangular, brass, wall type.
- I. Outlet: With pipe threads.
- J. Body Style: Horizontal.
- K. Number of Inlets: Two.
- L. Outlet Location: Back.
- M. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."
- N. Outlet Size: NPS 4-inch.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install wall-type fire department connections.
- B. Install automatic (ball-drip) drain valve at each check valve for fire department connection.

END OF SECTION

**SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Cover system for sprinkler piping.
  - 3. Specialty valves.
  - 4. Sprinklers.
  - 5. Manual control stations.
  - 6. Pressure gages.
- B. Related Requirements:
  - 1. Section 210523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For wet-pipe sprinkler systems.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include diagrams for power, signal, and control wiring.
  - 3. Valving
  - 4. Main riser details
  - 5. Siamese connections
  - 6. Water motor gong
  - 7. Ball drip
  - 8. Sprinkler locations and types
  - 9. Fire hose locations
  - 10. Hydraulic reference points
  - 11. Hanger locations
  - 12. Pipe sizes
  - 13. Drain valves and inspector's test connections.
  - 14. Most remote hydraulic area
  - 15. Flow switches
  - 16. Tamper switches
  - 17. Pressure switches
- C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which items of other systems and equipment are shown and coordinated with each other, using input from installers of the items involved.
- B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that

have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

- C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- D. Field quality-control reports.

#### 1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

#### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
  - 2. Contractor shall be fully licensed and accredited in the installation of automatic sprinkler and related fire protection equipment for a minimum of 5 years and shall be regularly engaged in this trade.

## PART 2 - PRODUCTS

#### 2.01 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Delegated Design: Engage a qualified professional engineer, with minimum 5 years' experience to design wet-pipe sprinkler systems.
  - 1. Sprinkler system design shall be approved by authorities having jurisdiction.
    - a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
    - b. Sprinkler Occupancy Hazard Classifications:
      - 1) Automobile Parking Areas: Ordinary Hazard, Group 1.
      - 2) Building Service Areas: Ordinary Hazard, Group 1.
      - 3) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      - 4) General Storage Areas: Ordinary Hazard, Group 1.
      - 5) Laundries: Ordinary Hazard, Group 1.
      - 6) Machine Shops: Ordinary Hazard, Group 2.
      - 7) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      - 8) Office and Public Areas: Light Hazard.
  - 2. Minimum Density for Automatic-Sprinkler Piping Design:

- a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
- b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
- c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
- 3. Maximum Protection Area per Sprinkler: According to UL listing.
- 4. Maximum Protection Area per Sprinkler:
  - a. Office Spaces: 120 sq. ft. 225 sq. ft.
  - b. Storage Areas: 130 sq. ft.
  - c. Mechanical Equipment Rooms: 130 sq. ft.
  - d. Electrical Equipment Rooms: 130 sq. ft.
  - e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.
- E. Where glass is incorporated as part of an interior fire rated partition, provide sprinkler coverage on both sides of the glass in the form of a water curtain as described in NFPA 13.
- F. In multi-story buildings, the sprinkler system for each floor shall be provided with sectionalizing valves, flow switches, and combination drain and inspectors test connections.
- G. Concealed spaces in buildings having combustible construction shall be protected with sprinklers.

## 2.02 STEEL PIPE AND FITTINGS

- A. Standard-Weight Galvanized and Black Steel Pipe: ASTM A 53/A 53M. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Galvanized and Black Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Black Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5-inch and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10-inch, plain end.
- E. Galvanized and Black Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- F. Galvanized and Uncoated Steel Couplings: ASTM A 865/A 865M, threaded.
- G. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- H. Malleable- or Ductile-Iron Unions: UL 860.
- I. Cast-Iron Flanges: ASME 16.1, Class 125.
- J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
  - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
- K. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. National Fittings, Inc.
    - b. Tyco Fire Products LP.

- c. Victaulic Company.
- 2. Pressure Rating: 175-psig minimum.
- 3. Galvanized Painted Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
- 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- L. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Victaulic Company.

## 2.03 CPVC PIPE AND FITTINGS

- A. CPVC Pipe: ASTM F 442/F 442M and UL 1821, SDR 13.5, for 175-psig rated pressure at 150 deg. F, with plain ends. Include "LISTED" and "CPVC SPRINKLER PIPE" markings.
- B. CPVC Fittings: UL listed or FM Global approved 175-psig rated pressure at 150 deg. F, socket type. Include "LISTED" and "CPVC SPRINKLER FITTING" markings.
  - 1. NPS 3/4-inch to NPS 1-1/2-inch: ASTM F 438 and UL 1821, Schedule 40, socket type.
  - 2. NPS 2-inch to NPS 3-inch: ASTM F 439 and UL 1821, Schedule 80, socket type.
  - 3. CPVC-to-Metal Transition Fittings: CPVC, one piece, with dimensions' equivalent to pipe; one end with threaded brass insert, and one socket end.
  - 4. CPVC-to-Metal Transition Unions: CPVC, with dimensions' equivalent to pipe; one end with threaded brass insert, and one socket end.
  - 5. Flanges: CPVC, one or two pieces.
- C. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493 solvent cement recommended by pipe and fitting manufacturer and made for joining CPVC sprinkler pipe and fittings. Include cleaner or primer recommended by pipe and fitting manufacturer.
- D. Plastic Pipe-Flange Gasket and Bolts and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.04 COVER SYSTEM FOR SPRINKLER PIPING

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. DecoShield Systems, Inc.
- B. Description: System of support brackets and covers made to protect sprinkler piping.
- C. Brackets: Glass-reinforced nylon.
- D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

## 2.05 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Specialty Valves Pressure Rating: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.

- F. Alarm Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Globe Fire Sprinkler Corporation.
    - b. Reliable Automatic Sprinkler Co., Inc. (The).
    - c. Tyco Fire Products LP.
    - d. Victaulic Company.
    - e. Viking Corporation.
  2. Standard: UL 193.
  3. Design: For horizontal or vertical installation.
  4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
  5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
  6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- G. Automatic (Ball Drip) Drain Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Reliable Automatic Sprinkler Co., Inc. (The).
    - b. Tyco Fire Products LP.
  2. Standard: UL 1726.
  3. Pressure Rating: 175-psig minimum.
  4. Type: Automatic draining, ball check.
  5. Size: NPS 3/4-inch.
  6. End Connections: Threaded.

## 2.06 SPRINKLER PIPING SPECIALTIES

- A. Branch Outlet Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. National Fittings, Inc.
    - b. Tyco Fire Products LP.
    - c. Victaulic Company.
  2. Standard: UL 213.
  3. Pressure Rating: 175-psig minimum.
  4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  5. Type: Mechanical-tee and -cross fittings.
  6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
  7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  8. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AGF Manufacturing Inc.
    - b. Reliable Automatic Sprinkler Co., Inc. (The).
    - c. Tyco Fire Products LP.
    - d. Victaulic Company.
  2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  3. Pressure Rating: 175-psig minimum 300 psig.



4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.
- C. Branch Line Testers:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elkhart Brass Mfg. Co., Inc.
    - b. Fire-End & Croker Corporation.
    - c. Potter Roemer LLC.
  2. Standard: UL 199.
  3. Pressure Rating: 175 psig.
  4. Body Material: Brass.
  5. Size: Same as connected piping.
  6. Inlet: Threaded.
  7. Drain Outlet: Threaded and capped.
  8. Branch Outlet: Threaded, for sprinkler.
- D. Sprinkler Inspector's Test Fittings:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AGF Manufacturing Inc.
    - b. Triple R Specialty.
    - c. Tyco Fire Products LP.
    - d. Victaulic Company.
    - e. Viking Corporation.
  2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  3. Pressure Rating: 175-psig minimum.
  4. Body Material: Cast- or ductile-iron housing with sight glass.
  5. Size: Same as connected piping.
  6. Inlet and Outlet: Threaded.
- E. Adjustable Drop Nipples:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aegis Technologies, Inc.
    - b. CECA, LLC.
    - c. Corcoran Piping System Co.
    - d. Merit Manufacturing.
  2. Standard: UL 1474.
  3. Pressure Rating: 250-psig minimum.
  4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
  5. Size: Same as connected piping.
  6. Length: Adjustable.
  7. Inlet and Outlet: Threaded.
- F. Flexible Sprinkler Hose Fittings:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Victaulic
    - b. Viking Corporation
  2. Standard: UL 1474.
  3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to

- ceiling grid.
- 4. Pressure Rating: 175-psig minimum.
- 5. Size: Same as connected piping, for sprinkler.

## 2.07 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Globe Fire Sprinkler Corporation.
  - 2. Reliable Automatic Sprinkler Co., Inc. (The).
  - 3. Tyco Fire Products LP.
  - 4. Viking Corporation.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
- D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- E. Automatic Sprinklers with Heat-Responsive Element:
  - 1. Early-Suppression, Fast-Response Applications: UL 1767.
  - 2. Nonresidential Applications: UL 199.
  - 3. Residential Applications: UL 1626.
  - 4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- F. Sprinkler Finishes: Chrome plated bronze and painted.
- G. Special Coatings: Wax lead and corrosion-resistant paint
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Reliable Automatic Sprinkler Co., Inc. (The).
    - b. Tyco Fire Products LP.
    - c. Victaulic Company.
    - d. Viking Corporation.
  - 2. Standard: UL 199.
  - 3. Type: Wire cage with fastening device for attaching to sprinkler.
- J. Sprinkler heads at the top of the elevator shaft shall be rated at 200°F. Sprinklers in swimming pools shall be rated for corrosive environments similar to Viking's electroless nickel plated sprinklers.
- K. Sprinkler heads in refrigerated boxes with temperatures below 40°F shall be dry pendants.
- L. Provide an allowance for an additional 12 heads and piping to cover architectural review and adjustment at shop drawing review. Design shall follow building lines, centers, and architectural features for a uniform, coordinated appearance.

## 2.08 MANUAL CONTROL STATIONS

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2-inch pipe nipple, and bronze ball valve.
- B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions

and cover held closed by breakable strut to prevent accidental opening.

## 2.09 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AGF Manufacturing Inc.
  - 2. AMETEK, Inc.
  - 3. Ashcroft Inc.
  - 4. Brecco Corporation.
  - 5. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2-inch to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0- to 250-psig minimum.
- E. Label: Include "WATER" label on dial face.

## 2.10 SPRINKLER HEAD CABINET

- A. Cold rolled steel, red enamel box, labeled "SPRINKLER HEADS", storage for 12 sprinkler heads, hinged cover.
- B. Complete with 12 sprinklers of the type used on the project.
- C. Located at the fire service entrance, wall mounted.

# PART 3 - EXECUTION

## 3.01 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.
- B. Install shutoff valve backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

## 3.02 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 221119 "Domestic Water Piping Specialties."
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

## 3.03 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2-inch and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2-inch and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 21 05 48 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4-inch and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they are not subject to freezing.
- N. Fill sprinkler system piping with water.

### 3.04 JOINT CONSTRUCTION

- A. Joining method: Joints NPS 2-inch and smaller shall be threaded; Joints NPS 2-1/2-inch and larger shall be grooved mechanical joints.
- B. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- C. Install unions adjacent to each valve in pipes NPS 2-inch and smaller.
- D. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2-inch and larger end connections.
- E. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- F. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- G. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or

damaged.

- I. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- J. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Steel-Piping, Pressure-Sealed Joints: Join steel pressure-seal fittings with tools recommended by fitting manufacturer.
- N. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2154. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- O. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- P. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe handling practice of cleaners, primers, and solvent cements. Apply primer.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

### 3.05 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
  - 3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

### 3.06 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

### 3.07 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Electrical Specifications.

### 3.08 FIELD QUALITY CONTROL

- A. Perform the following tests and inspection with the assistance of a factory-authorized service representative:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
  - 6. Coordinate with fire-pump tests. Operate as required.
  - 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.09 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

### 3.10 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded or grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. CPVC pipe, Schedule 40CPVC fittings, and solvent-cemented joints may be used for light-hazard and residential occupancies.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-inch and smaller, shall be one of the following:
  - 1. Standard weight or Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  - 2. Standard weight or Schedule 40, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
  - 3. Standard or Schedule 40, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- E. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2-inch to NPS 4-inch shall be one of the following:
  - 1. Standard weight or Schedule 30 black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Standard weight or Schedule 30, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- F. Standard-pressure, wet-pipe sprinkler system, NPS 5-inch and larger, shall be one of the following:
1. Standard weight or Schedule 10, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  2. Standard weight or Schedule 10, black-steel pipe with cut or roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### 3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
  2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.
  3. Wall Mounting: Sidewall sprinklers.
  4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
  5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated Attic sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
  3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  4. Residential Sprinklers: Dull chrome.
  5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

**DIVISION 22 - PLUMBING****SECTION 22 05 00 - STANDARD CONDITIONS FOR PLUMBING****PART 1 - GENERAL****1.01 REFERENCE**

- A. Requirements established within the portions of this project manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and addenda as issued are part of this specification.
- C. Plumbing drawings along with all other project drawings and specifications represent the work of this section.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

**1.02 SCOPE**

- A. Provide labor, material, equipment and supervision necessary to install complete operating plumbing systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.
- B. It shall be the contractor's responsibility to coordinate his work and the work of his subcontractors to ensure that all the work is covered. He shall designate who is responsible for various portions of work which may overlap so that there is complete coverage of all required work. It is the position of the owner and the A/E that all work is the responsibility of the mechanical contractor within this division of the work.
- C. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
- D. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- E. Plumbing contractor's scope of work shall include but not be limited to the following:
  - 1. Domestic water system and insulation (See Section 22 11 16, 22 07 00 and 22 40 00).
  - 2. Sanitary and vent system. (See Section 22 13 00)
  - 3. Storm and overflow systems and any insulation (See Section 22 07 00 and 22 13 00).
  - 4. All other work in Division 22.
  - 5. Roof penetrations for plumbing work.
  - 6. Demolition of existing work to accommodate new work.
  - 7. Fire stopping of penetrations. (See Section 22 05 50).

**1.03 REGULATIONS, CODES, AND STANDARDS**



- A. Work shall be performed in accordance with the latest adopted codes, amendments, regulations, and ordinances of the authorities having jurisdiction. Observe all safety regulations including the requirements of OSHA.
- B. Obtain and pay for all permits, connection charges, inspections, and certificates required to complete the work.
- C. Latest editions of any referenced standards shall govern.
- D. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

#### 1.04 SUBMISSIONS

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A/E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
- D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
- E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- F. Contractor to forward a copy of submittals which have electrical requirements to the Electrical Contractor (EC) for coordination of voltage, amperage, and phase. Response to be received from EC prior to ordering of equipment by mechanical contractor.
- G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, drains shall be combined in a single brochure with all items being furnished clearly identified.
- H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and coordinated with all other trades.
- I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.
- J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.
- K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for

providing the changes to the requested file format may be necessary at \$150/hr. billable to the contractor.

#### 1.05 SITE INSPECTION

- A. Visit site, inspect, and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of bid will be deemed evidence of having complied with this request. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.

#### 1.06 SUBSTITUTIONS

- A. Material and equipment specified shall be deemed as that which the bidder's quotation represents the contractor.
- B. Once bids are accepted only that material and equipment listed in the specifications or added by addenda shall be acceptable. Substitution information for inclusion in an addenda must be received by the A/E at least 10 days prior to bid opening. If acceptable, an addenda will be issued which will add the additional acceptable manufacturers or materials and be available for all contractors to consider. It shall be a basic premise that a contractor is a lowest bidder because he utilized substituted materials or equipment as opposed to specified materials or equipment.
- C. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of \$150.00/hr. for such services. Also, billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval or rejection.
- D. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

#### 1.07 DRAWINGS AND SPECIFICATIONS

- A. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.
- B. When a conflict or contradiction exists either between drawings and specs or between specs or between different drawings or details, the more stringent shall apply.
- C. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- D. An item shown on the drawings and not indicated in the specifications is to be understood to

be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.

- E. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.
- F. If a question arises after bidding the A/E interpretation shall govern.

#### 1.08 MEASUREMENTS

- A. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

#### 1.09 PROGRESS SCHEDULE

- A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

#### 1.10 COST SCHEDULE

- A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.
- B. AIA forms are required for this submission.

#### 1.11 COMPLETION

- A. The contractor shall deliver to the owner, with his request for final payment, copies of all manufacturer's guarantees, equipment instructional manuals, a complete set of all final shop drawings, catalog cuts, service contracts, and other items as may be required elsewhere in the documents.

#### 1.12 OFFICE

- A. The contractor shall set up his job office (desk) where directed by the owner.

#### 1.13 STORAGE

- A. Material shall be stored only where directed by the owner.

#### 1.14 SANITARY

- A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
- B. Toilet will be located where directed by the owner.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. All material shall be new and of present day manufacture.
- B. All material and equipment shall be in conformance with accepted trade standards.
- C. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed to apply to as many such items as may be necessary to complete the installation.
- D. The word "provide" means "furnish and install complete, tested, and adjusted as necessary with all accessories, covers, escutcheons". The word "piping" means pipe, fitting, controls, valves and hangers as required for a complete system.

## 2.02 MOTORS

- A. Incorporate latest IEEE and NEMA standards.
- B. All copper windings with ball bearings.
- C. Indoors; drip proof, 40 degree C rise.
- D. Outdoors; totally enclosed 55 degree C rise.
- E. Motors over 10 HP to be high efficiency with PF in excess of 0.9.

## 2.03 MOTOR STARTERS AND CONTACTORS

- A. Fractional with horsepower up to ½ HP; electrical contract.
- B. Polyphase and single phase above ½ HP: this contract.
- C. Electrical contractor shall install all starters except for those provided as an integral part of equipment.
- D. Polyphase starters shall be magnetic combination type, across-the-line electrically operated, electrically held, three pole assemblies, with arc extinguishing characteristics, silver to silver renewable contacts, 3 pole thermal bi-metallic, red run pilot light, individual phase protection, with overload heaters matched to motors installed and with 4 auxiliary contact, Hand-off-Auto switch, and control transformer.
- E. For single phase motors above ½ HP provide magnetic combination single phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing auxiliary contacts.
- F. Starters shall be as manufactured by G. E., Siemens, Square "D" or Cutler-Hammer.

## 2.04 EQUIPMENT START UP

- A. Verify that equipment is operating within warranty requirements.
- B. Advise owner and A/E at least two days prior.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to A/E.

## 2.05 LUBRICATION

- A. Lubricate all equipment in accordance with manufacturer's instructions.
- B. Lubricate prior to start up.
- C. Provide one years' supply of lubricants to the owner.

## 2.06 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner's personnel in the operation and maintenance of all systems and equipment.
- B. Ensure that the owner's personnel are familiar with all operations to carry on required

- activities.
- C. Such instruction shall be for each item of equipment and each system as a whole.
- D. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, control sequences, service requirements, piping diagrams, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.
- E. Provide to the owner any special tools necessary to operate any of the equipment.

#### 2.07 DRAIN PANS

- A. All water heaters mounted above the floor shall be provided with drain pans. Drain to suitable discharge point acceptable to owner and A/E. To be visible outfall.
- B. Drains shall slope down in direction of flow at 1" per 10 feet.

### PART 3 - EXECUTION

#### 3.01 PROTECTION

- A. Plug or cap open ends of piping systems and conduit.
- B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
- C. Protect all installed work until accepted in place by the owner. Cover plumbing fixtures.
- D. Do not install plates, polished metal escutcheons, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
- E. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulating, and covering.

#### 3.02 WORKMANSHIP

- A. Install all work neat, trim, and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

#### 3.03 EXCAVATION, SHORING, PUMPING, BACKFILLING

- A. Perform all excavation required to install the work. Deposit excavated material so as not to create a slide hazard.
- B. No work shall be placed on rock. Cushion with 6" layer of crushed stone.
- C. Protect tree roots with burlap covering and maintain moist until backfilled.
- D. Base estimates on excavation which will include earth, sand, clay, rubbish, debris, and all other materials up to one cubic yard in size. Boulders or rock larger than one cubic yard which need to be broken up with pneumatic equipment or explosives will be separately negotiated at the time of discovery with the owner and A/E. Do not proceed with rock excavation until an agreement is reached.
- E. Maintain excavations free of water.
- F. Shore excavations to prevent cave-in in accordance with OSHA regulations and to prevent strains on work put in place until ready to receive backfill.

- G. Backfill with clean material and pneumatically tamp in 8" layers. Remove excess material, including rock, from site or as directed by the A/E.
- H. Backfill piping trenches within 18" of footings, columns, piers, or grade beams, with concrete. Protect piping from direct contact and adherence to concrete.
- I. Return to original condition any areas disturbed for excavation.

#### 3.04 FASTENERS, HANGERS, AND SUPPORTS

- A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.
- B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets, and anchors to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded to more than 1/4 rated capacity with a minimum of 200 lbs.
- E. Powder driven fasteners shall not be allowed for piping larger than 2", or for equipment. When used they shall not be loaded more than 1/8 rated capacity with a minimum of 200 lbs.
- F. All hangers, miscellaneous steel, braces, and supports shall be galvanized, cadmium plated, or painted with corrosion resistant primer and finish coat of epoxy enamel.
- G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles at not more than 8-foot centers up to 1 1/4" dia. and 10-foot centers above 1 1/4" dia. Piping shall not support other piping.
- H. Support vertical piping at floor levels. Piping shall have split rings.
- I. Provide and install lintels where required for mechanical work and not indicated on architectural or structural drawings.
- J. Furnish steel framing for roof openings and floor openings. Submit details for review.

#### 3.05 SLEEVES

- A. All piping passing through floors or walls shall have sleeves unless holes are cored. Sleeves shall be 16-gauge galvanized steel in non-bearing walls, 10 gage galvanized steel for bearing walls, and schedule 40 galvanized pipe in floors. Sleeves shall accommodate insulation. This shall not apply to sprinkler piping.
- B. Sleeves passing through foundation walls not exposed to interior spaces or sleeves passing through slab on grade may be schedule 40 PVC.
- C. Wall sleeves shall finish flush with wall.
- D. Floor sleeves shall extend 1 inch above floor.
- E. Sleeves in walls between interior spaces and unexcavated, exterior, crawl, or backfilled spaces shall be made watertight with "Link-Seal" modular wall and casing seal. Casing shall be schedule 40 galvanized pipe with anchor flange.

#### 3.06 PLATES

- A. Furnish and install chrome plated plates wherever piping passes into finished areas.
- B. Plates shall be securely fastened to piping or building construction.
- C. Floor plates shall cover one inch floor extension.

#### 3.07 OFFSETS, TRANSITIONS, MODIFICATIONS

- A. Furnish and install all offsets necessary to install the work and to provide clearance for the other trades.
- B. Maintain adequate headroom and clearance as directed by the A/E.
- C. Ductwork transitions necessary to accommodate available space or clearance requirements

shall be contract requirements.

- D. Incidental modifications necessary to the installation of the systems shall be made as necessary and at the direction of the A/E.
- E. Rises and drops of piping systems shall be provided as required and where directed to allow for clearances to other construction. Drains shall be installed at no additional cost to the owner. The contractor shall allow for such occurrences in his bid.
- F. Piping and equipment shall be so arranged as to not pass in front of windows, doors, access panels, access doors, coil removal or filter removal space or service clearance areas. Do not install within 3'-0" clearance of electrical panel fronts.

### 3.08 RECESSES

- A. Furnish information to the general contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment or devices which are to be recessed into walls.
- B. Make offsets or modifications as required to suit final locations.

### 3.09 EQUIPMENT SETTING

- A. Furnish and install as a minimum, a 4" thick concrete pad beneath all floor mounted equipment in mechanical rooms, boiler rooms, or equipment rooms, or outside on grade. This shall not apply to residential installations of water heaters unless detailed on drawings or specified elsewhere.
- B. Furnish and install as a minimum, spring vibration isolators under any equipment 5 HP and over and rubber-in-shear vibration isolation under all equipment less than 5 HP. This shall apply to residential installations.
- C. Reinforce concrete with No. 4 rods 12" on centers both ways.
- D. Pad to have 3/4" dowels into concrete at 1 per 4 square feet.

### 3.10 LABELING

- A. All equipment shall be provided with permanent black laminated white core labels with 3/8" letters.

### 3.11 FLASHING AND COUNTER-FLASHING

- A. Roof drains and overflow drains shall have counter-flashing fittings. General contractor shall provide flashing.
- B. Piping and conduit through the roof shall be flashed by the General Contractor. This contractor shall furnish counterflashing.

### 3.12 ACCESS

- A. Locate all equipment, valves, devices and controllers which may need service in accessible places.
- B. Where access is not available; access panels shall be provided. Furnish prime painted steel access doors to the General Contractor for installation.
- C. Access doors shall be 16-gauge frames and 22 gauge steel door. Access doors in fire rated walls shall have a "B" label for 1 ½ hours.
- D. Maintain clearances for tube removal, coil pulls, and filter removal.

### 3.13 WIRING

- A. Power wiring shall be provided by the Division 16 Electrical Contractor. This contractor shall furnish all 3 phase starters, pushbuttons, and controllers necessary to operate the equipment. The Electrical Contractor shall store and install the electrical devices and furnish and install the power wiring.
- B. Control wiring shall be furnished and installed under Division 26 portion of the work. Wiring for controls is control wiring whether it is line voltage or low voltage.
- C. All wiring shall be in accordance with the NEC.
- D. Pushbuttons shall be maintain-contact type.
- E. Refer to the electrical specifications for wiring methods.
- F. Plenum rated cable is required for control wiring.

### 3.14 UTILITIES

- A. Do not interrupt any utility or service without adequate previous notice and scheduling with the owner.
- B. Refer to Division 1 for requirements for providing temporary utilities.

### 3.15 CUTTING AND PATCHING EXTERIOR SERVICES

- A. This contractor shall be responsible for returning disturbed areas to original condition where excavation for utilities has been required.
- B. Cut and patch paved areas to match original surfaces.
- C. Properly tamp backfill before finishing surfaces.
- D. Concrete pavements and curbs shall be formed and poured to match adjacent areas.
- E. Grass areas shall be sodded and maintained until established growth is achieved.

### 3.16 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the owner unless otherwise specified. Material and labor for first year warranty is to be provided.
- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.
- C. Compressor system components shall be provided with a 5-year factory warranty. Material only for years 2 through 5 is required.

### 3.17 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver material and equipment in manufacturer's original cartons or on skids.
- B. Store material in dry enclosures or under protective coverings out of way of work progress.
- C. Handle so as to prevent damage to product or any surrounding material.

### 3.18 MANUFACTURERS' NAMES

- A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any



- deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.
- B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

### 3.19 AS-BUILT DRAWINGS

- A. At the completion of the work the contractor shall furnish a reproducible as-built drawings to the A/E for approval. The drawings shall indicate all work installed and its actual size and location. If acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
- C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150/hr. billable to the contractor.

### 3.20 PENETRATION SEALING

- A. All penetrations of fire walls, smoke walls, and floors by pipes or wiring shall be sealed to prevent the flow of gasses or smoke.
- B. The sealant shall be foamed in place between the penetrant and the adjacent floor or wall with DOW Corning RTV foam or equivalent by 3M, Hilti, or Chase foam.
- C. The installation shall meet the approval of the authority having jurisdiction.
- D. Penetrations through rated surfaces shall have a UL rating equivalent to the adjacent surfaces.

### 3.21 CUTTING AND PATCHING INTERIOR SURFACES

- A. Respective contractor shall install all hangers, supports, pipe sleeves in floors, walls, partitions, ceilings and roof slabs as construction progresses to permit their work to be built into place and to eliminate unnecessary cutting of construction work.
- B. All cutting of concrete, or other material for the passage of piping through floors, walls, partitions and ceiling shall be done by the respective contractor where necessary to install his work. Respective contractor will close all such openings around piping with materials equivalent to that removed. All exposed surfaces shall be left in suitable condition for refinishing without further work.
- C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

### 3.22 INVERTS AND ELEVATIONS

- A. Indicated inverts and elevations of existing utilities are approximate and based on the best information available.
- B. Upon award of contract, contractor shall verify in the field all such information and report

any discrepancies before proceeding with work. Contractor shall be responsible for extra work caused by his failure to verify inverts and elevations.

### 3.23 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

- A. Furnish and install final connections to equipment furnished in other parts of the specification or furnished by the owner. Provide drainage connections, vent connections, water connections, fuel gas connections, gas connections to the fixtures or equipment. Plumbing connections shall include valved supplies and trapped waste connections.

### 3.24 COORDINATION DRAWINGS

- A. Provide 3/8" = 1'-0" scale drawings showing all coordinated ductwork, piping, conduit, and equipment of all trades.
- B. The sheet metal shop drawings may be used as the basis of these drawings.
- C. Show ductwork, walls, beams, steel, drainage piping, domestic water piping, HVAC piping, sprinkler piping, light fixtures, electrical conduit and equipment.
- D. Contact other disciplines and obtain information to identify fully coordinated systems.
- E. Submit for review and approval to the A/E.
- F. Provide all dimensional data and necessary clearances to other trades for installation of fixtures and equipment within casework and counter tops.
- G. Work shall not proceed until coordination is completed and all conflicts, issues, sequences etc., are resolved.

### 3.25 WELDING

- A. All electric power for arc welding shall be supplied by the contractor performing the work.

### 3.26 VEHICLES

- A. Vehicle access to the site will be as directed by the owner.

### 3.27 RUBBISH DISPOSAL

- A. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

### 3.28 PROTECTION

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.

### 3.29 SCAFFOLDING

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

### 3.30 UTILITIES (Applies only to existing facilities)

- A. The contractor may use the existing water and electric power for temporary construction

needs.

- B. The owner will direct where these services may be tapped.
- C. Those services that are used during construction, but are to remain, shall be refurbished to as new condition before turning back to the owner.

### 3.31 CLEANUP

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Clean and polish all plumbing fixtures.
- D. Remove all trash and debris from the premises.

### 3.32 MOUNTING HEIGHTS

- A. Contractor to coordinate all mounting heights with all trades and architect prior to rough-in.

### 3.33 WORK COMPLETION

- A. The contractor shall promptly correct work rejected by the engineer failing to conform to the requirements of the contract documents, whether discovered before or after substantial completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

### 3.34 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

- A. All RFI's shall include the following information based on AIA Document G716:
  - 1 To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
  - 2 Provide a description with specification and/or drawing references.
  - 3 Provide the senders recommendation including cost and/or schedule considerations.
  - 4 Provide receiver's reply space.
  - 5 Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

### 3.35 SHOP DRAWING REQUIREMENTS

- A. The following is a list of required shop drawings for the project. Not all items may be identified, and it is the responsibility of the contractor to submit additional shop drawings where indicated in the specifications.

PLUMBING	DATE REC'D	ACTION	DATE REC'D	ACTION
COORDINATION DRAWINGS				
VALVES, STRAINERS				
BACKFLOW PREVENTORS				

<b>PLUMBING</b>	<b>DATE REC'D</b>	<b>ACTION</b>	<b>DATE REC'D</b>	<b>ACTION</b>
MIXING VALVES				
PIPING/FITTINGS/LABELING				
DRAINS				
FIXTURES/TRIM/CARRIERS				
SAND INTERCEPTOR				
ELEVATOR PIT SUMP PUMPS				
INSULATION A. HANDICAP COVERS B. DOMESTIC WATER PIPING				
WATER HEATERS (ELECTRIC)				
HOT WATER RETURN PUMPS				
AS-BUILT DRAWINGS/ELECTRONIC AS-BUILT				
WARRANTIES AND GUARANTEES				
OPERATIONS AND MAINTENANCE MANUALS				
INSTRUCTIONS				
TESTS/CERTIFICATIONS				
EMERGENCY AND MANUFACTURER CONTACTS				

END OF SECTION

**SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

**1.02 COORDINATION**

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

**PART 2 - PRODUCTS****2.01 GENERAL MOTOR REQUIREMENTS**

- A. Comply with NEMA MG 1 unless otherwise indicated.

**2.02 MOTOR CHARACTERISTICS**

- A. Duty: Continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

**2.03 POLYPHASE MOTORS**

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

- G. Temperature Rise: Match insulation rating.
- H. Insulation:
- I. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

#### 2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

#### 2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

END OF SECTION

**SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 SLEEVES**

- A. Cast Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

**2.02 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. GPT; an EnPro Industries company.
  - 3. Metraflex Company (The).
  - 4. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

**2.03 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.01 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### **3.02 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves.



- b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves.
- 2. Exterior Concrete Walls below Grade:
  - a. Piping Smaller Than NPS 6-inch Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
  - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6-inch and Larger: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6-inch: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6-inch and Larger: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
  - a. Piping Smaller Than NPS 6-inch: Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6-inch and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

**SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons
  - 2. Floor plates

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 ESCUTCHEONS**

- A. One Piece, Cast-Brass Type: With polished, chrome-plated, and rough-brass finish and setscrew fastener.
- B. One Piece, Deep-Pattern Type: Deep-drawn, box shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One Piece, Stamped-Steel Type: With chrome plated finish and spring-clip fasteners.

**2.02 FLOOR PLATES**

- A. One Piece Floor Plates: Cast-iron flange with holes for fasteners.

**PART 3 - EXECUTION****3.01 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

- e. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast-brass type with polished, chrome-plated finish.
  - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
  - g. Bare Piping in Equipment Rooms: One piece, cast-brass type with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping: One piece, floor plate type.

### 3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

**SECTION 22 05 19 - THERMOMETERS AND GAUGES FOR PLUMBING PIPING****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Bimetallic-actuated thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Thermowells.
  - 4. Dial-type pressure gages.
  - 5. Gage attachments.

**1.03 ACTION SUBMITTALS**

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

**1.04 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of meter and gage.

**1.05 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

**PART 2 - PRODUCTS****2.01 BIMETALLIC-ACTUATED THERMOMETERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ashcroft Inc.
  - 2. Nanmac Corporation.
  - 3. Palmer Wahl Instrumentation Group.
  - 4. Watts; a Watts Water Technologies company.
  - 5. Weiss Instruments, Inc.
  - 6. Weksler Glass Thermometer Corp.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg. F and deg. C.
- E. Connector Type(s): Union joint, [adjustable angle] [rigid, back] [and] [rigid, bottom] <Insert type>, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass or plastic.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus, or minus 1 percent of scale range.

## 2.02 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
  - 1. Standard: ASME B40.200.
  - 2. Case: Cast aluminum; 6-inch nominal size.
  - 3. Case Form: Back angle unless otherwise indicated.
  - 4. Tube: Glass with magnifying lens and blue or red organic liquid.
  - 5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg. F and deg. C.
  - 6. Window: Glass or plastic.
  - 7. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 8. Connector: 3/4 inch, with ASME B1.1 screw threads.
  - 9. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Flo Fab Inc.
    - b. Miljoco Corporation.
    - c. Palmer Wahl Instrumentation Group.
    - d. Tel-Tru Manufacturing Company.
    - e. Trerice, H. O. Co.
    - f. Weiss Instruments, Inc.
    - g. Weksler Glass Thermometer Corp.
    - h. Winters Instruments - U.S.
  - 2. Standard: ASME B40.200.
  - 3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
  - 4. Case Form: Adjustable angle Back angle unless otherwise indicated.
  - 5. Tube: Glass with magnifying lens and blue or red organic liquid.
  - 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg. F and deg. C.
  - 7. Window: Glass or plastic.
  - 8. Stem: Aluminum and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 9. Connector: 1 1/4 - inches, with ASME B1.1 screw threads.
  - 10. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.03 THERMOWELLS

### A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1-inch, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

### B. Heat-Transfer Medium: Mixture of graphite and glycerin

## 2.04 PRESSURE GAGES

### A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ametek U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Ernst Flow Industries.
  - d. Flo Fab Inc.
  - e. Noshok.
  - f. Palmer Wahl Instrumentation Group.
  - g. REOTEMP Instrument Corporation.
  - h. Watts; a Watts Water Technologies company.
  - i. Weiss Instruments, Inc.
  - j. Weksler Glass Thermometer Corp.
  - k. WIKA Instrument Corporation.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4 1/2 -inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 -inch ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

### B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ametek U.S. Gauge.

- b. Ashcroft Inc.
  - c. Flo Fab Inc.
  - d. Noshok.
  - e. Palmer Wahl Instrumentation Group.
  - f. Watts; a Watts Water Technologies company.
  - g. Weiss Instruments, Inc.
  - h. WIKA Instrument Corporation.
- 2. Standard: ASME B40.100.
  - 3. Case: Liquid-filled Sealed type; cast aluminum or drawn steel 4 ½ -inch nominal diameter with back flange and holes for panel mounting.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4-inch ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
  - 8. Pointer: Dark-colored metal.
  - 9. Window: Glass or plastic.
  - 10. Ring: Metal.
  - 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.05 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4-inch, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, NPS 1/4-inch B1.20.1 pipe threads.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install thermometers in the following locations:
  - 1. Inlet and outlet of each water heater.
  - 2. Inlets and outlets of each domestic water heat exchanger.
  - 3. Inlet and outlet of each domestic hot-water storage tank.

- 4. Inlet and outlet of each remote domestic water chiller.
- K. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Inlet and outlet of each pressure-reducing valve.
  - 3. Suction and discharge of each domestic water pump.
- L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- M. Adjust faces of meters and gages to proper angle for best visibility.

### 3.02 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
  - 1. Liquid-filled Sealed, bimetallic-actuated type.
  - 2. Metal case, compact industrial-style, liquid-in-glass type.
- B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:
  - 1. Liquid-filled Sealed, bimetallic-actuated type.
  - 2. Metal case, compact industrial-style, liquid-in-glass type.
- C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:
  - 1. Liquid-filled Sealed, bimetallic-actuated type.
  - 2. Metal case, compact industrial-style, liquid-in-glass type.
- D. Thermometers at inlet and outlet of each remote domestic water chiller shall be one of the following:
  - 1. Liquid-filled Sealed, bimetallic-actuated type.
  - 2. Metal case, compact industrial-style, liquid-in-glass type.
- E. Thermometer stems shall be of length to match thermowell insertion length.

### 3.03 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg. F and minus 20 to plus 50 deg. C
- B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg. F and 0 to plus 115 deg. C.
- C. Scale Range for Domestic Cooled-Water Piping: 0 to 100 deg. F and minus 20 to plus 50 deg. C.

### 3.04 PRESSURE GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be one of the following:
  - 1. Liquid-filled Sealed Solid-front, pressure-relief, direct mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
  - 1. Liquid-filled Sealed Solid-front, pressure-relief, direct mounted, metal case.
  - 2. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
  - 1. Liquid filled Sealed Solid front, pressure relief direct mounted, metal case.
  - 2. synthetic self-sealing rubber inserts.

### 3.05 PRESSURE GAGE SCALE RANGE SCHEDULE



- A. Scale Range for Water Service Piping: 0 to 160 psi and 0 to 1100 kPa.
- B. Scale Range for Domestic Water Piping: 0 to 100 psi 0 to 600 kPa.

END OF SECTION

**SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Bronze ball valves.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 Annex G and NSF 372.

**PART 2 - PRODUCTS****2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 3. ASME B16.18 for solder-joint connections.
  - 4. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
  - 2. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
  - 1. Include 2-inch stem extensions.
  - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
  - 3. Memory stops that are fully adjustable after insulation is applied.

**2.02 BRONZE BALL VALVES**

- A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:
  - 1. Manufacturers:

- a. Apollo Valves
  - b. Hammond Valve
  - c. Milwaukee Valve Co.
  - d. NIBCO Inc.
  - e. Red-White Valve Corp.
  - f. Stockham
  - g. Viega LLC
  - h. WATTS
  - i. Zurn Industries, LLC
2. Description:
- a. Standard: MSS SP-110.
  - b. CWP Rating: 600 psig.
  - c. Body Design: Two piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Bronze or brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Full.

### **PART 3 - EXECUTION**

#### **3.01 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

#### **3.02 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

#### **3.03 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Bronze ball valves, two-piece with full port and bronze or brass trim.

END OF SECTION

**SECTION 22 05 23.14 - CHECK VALVES FOR PLUMBING PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Bronze swing check valves.
  2. Iron swing check valves.
  3. Iron swing check valves with closure control.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
1. Certification that products comply with NSF 61 Annex G and NSF 372.

**PART 2 - PRODUCTS****2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
  2. ASME B16.1 for flanges on iron valves.
  3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  4. ASME B16.18 for solder joint.
  5. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Bypass and Drain Connections: MSS SP-45.

**2.02 BRONZE SWING CHECK VALVES**

- A. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane; Crane Energy Flow Solutions.
    - b. Hammond Valve.
    - c. Jenkins Valves; Crane Energy Flow Solutions.

- d. Milwaukee Valve Company.
- e. NIBCO INC.
- f. Red-White Valve Corporation.
- g. Stockham; Crane Energy Flow Solutions.
- h. Watts; a Watts Water Technologies company.
- 2. Description:
  - a. Standard: MSS SP-80, Type 4.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded or soldered. See valve schedule articles.
  - f. Disc: PTFE.

## 2.03 IRON SWING CHECK VALVES

- A. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane; Crane Energy Flow Solutions.
    - b. Stockham; Crane Energy Flow Solutions.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged or threaded. See valve schedule articles.
    - f. Trim: Composition.
    - g. Seat Ring: Bronze.
    - h. Disc Holder: Bronze.
    - i. Disc: PTFE.
    - j. Gasket: Asbestos free.

## 2.04 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane; Crane Energy Flow Solutions.
    - b. Hammond Valve.
    - c. Jenkins Valves; Crane Energy Flow Solutions.
    - d. Milwaukee Valve Company.
    - e. NIBCO INC.
    - f. Stockham; Crane Energy Flow Solutions.
    - g. Watts; a Watts Water Technologies company.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged or threaded. See valve schedule articles.
    - f. Trim: Bronze.

- g. Gasket: Asbestos free.
      - h. Closure Control: Factory-installed exterior lever and spring.
- B. Iron Swing Check Valves with Lever and Weight-Closure Control, Class 125:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. Crane; Crane Energy Flow Solutions.
    - c. Hammond Valve.
    - d. Jenkins Valves; Crane Energy Flow Solutions.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. Stockham; Crane Energy Flow Solutions.
    - h. Watts; a Watts Water Technologies company.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged or threaded. See valve schedule articles.
    - f. Trim: Bronze.
    - g. Gasket: Asbestos free.
    - h. Closure Control: Factory installed exterior lever and weight.

### **PART 3 - EXECUTION**

#### **3.01 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

#### **3.02 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

#### **3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valve applications are not indicated, use the following:
  - 1. Pump-Discharge Check Valves:
    - a. NPS 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    - b. NPS 2 ½ - inch and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; metal-seat or resilient-seat check valves.

- c. NPS 2 ½ - inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. End Connections:
  - 1. For Copper Tubing, NPS 2-inch and Smaller: Threaded or soldered.
  - 2. For Copper Tubing, NPS 2 ½ -inch to NPS 4-inch: Flanged
  - 3. For Copper Tubing, NPS 5-inch and Larger: Flanged.
  - 4. For Steel Piping, NPS 2-inch and Smaller: Threaded.
  - 5. For Steel Piping, NPS 2 ½ -inch to NPS 4-inch: Flanged
  - 6. For Steel Piping, NPS 5-inch and Larger: Flanged.

### 3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2-inch and Smaller: Bronze swing check valves bronze nonmetallic disc, Class 125, with soldered or threaded end connections.
- B. Pipe NPS 2 ½ - inch and Larger:
  - 1. Iron swing check valves with metal nonmetallic-to-metal seats, Class 125, with threaded or flanged end connections.

END OF SECTION

**SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Pipe positioning systems.
  - 6. Equipment supports.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

**1.04 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

**1.05 QUALITY ASSURANCE**

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."



- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## **PART 2 - PRODUCTS**

### **2.01 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

### **2.02 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### **2.03 THERMAL-HANGER SHIELD INSERTS**

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100- or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

### **2.04 FASTENER SYSTEMS**

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

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

#### 2.05 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

#### 2.06 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

#### 2.07 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

### PART 3 - EXECUTION

#### 3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts,

- washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
  - H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
  - I. Install lateral bracing with pipe hangers and supports to prevent swaying.
  - J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2-inch and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
  - K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
  - L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
  - M. Insulated Piping:
    - 1. Attach clamps and spacers to piping.
      - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
    - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4-inch and larger if pipe is installed on rollers.
    - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4-inch and larger if pipe is installed on rollers.
    - 4. Shield Dimensions for Pipe: Not less than the following:
      - a. NPS 1/4-inch to NPS 3 1/2 -inch: 12 inches long and 0.048 inch thick.
      - b. NPS 4-inch: 12 inch long and 0.06 inch thick.
      - c. NPS 5-inch and NPS 6-inch: 18 inches long and 0.06 inch thick.
      - d. NPS 8-inch to NPS 14-inch: 24 inches long and 0.075 inch thick.
      - e. NPS 16-inch to NPS 24-inch: 24 inches long and 0.105 inch thick.
    - 5. Pipes NPS 8-inch and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
    - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1 ½ - inch.

### 3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. galvanizing-repair paint to comply with ASTM A 780.

### 3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2-inch to NPS 30-inch.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg. F, pipes NPS 4-inch to NPS 24-inch, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4-inch to NPS 36-inch, requiring clamp flexibility and up to 4 inches of

- insulation.
- 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2-inch to NPS 8-inch.
- 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2-inch to NPS 30-inch.
- 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4-inch to NPS 36-inch, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
- 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4-inch to NPS 36-inch, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
- 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1-inch to NPS 30-inch, from two rods if longitudinal movement caused by expansion and contraction might occur.
- 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2-inch to NPS 42-inch if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg. F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  - 6. C-Clamps (MSS Type 23): For structural shapes.
  - 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  - 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  - 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  - 2. Protection Shields (MSS Type 40): Of length recommended in writing by

- 3. manufacturer to prevent crushing insulation.
- 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1 ¼ inches.
  - 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  - 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

**SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
1. Manufacturers:
    - a. Brady Corporation
    - b. Brimar Industries, Inc.
    - c. Craftmark Pipe Makers
    - d. Marking Services, Inc.
    - e. Seton Identification Products
  2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  3. Letter Color: Black.
  4. Background Color: Yellow.
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers

where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.02 WARNING SIGNS AND LABELS

- A. Manufacturers:
  - 1. Brady Corporation
  - 2. Brimar Industries, Inc.
  - 3. Craftmark Pipe Makers
  - 4. Marking Services Inc.
  - 5. National Marker Company
  - 6. Seton Identification Products
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: Yellow.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets or self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

## 2.03 PIPE LABELS

- A. Manufacturers:
  - 1. Brady Corporation
  - 2. Brimar Industries, Inc.
  - 3. Craftmark Pipe Makers
  - 4. Marking Services Inc.
  - 5. Seton Identification Products
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: Size letters according to ASME A13.1 for piping At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.



**PART 3 - EXECUTION****3.01 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

**3.02 PIPE LABEL INSTALLATION**

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings unfinished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
  - 1. Domestic Water Piping
    - a. Background: Safety green.
    - b. Letter Colors: White.
  - 2. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Yellow
    - b. Letter Color: Black.

END OF SECTION

**SECTION 22 07 19 - PLUMBING PIPING INSULATION****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic hot-water piping.
  - 2. Domestic recirculating hot water piping.
  - 3. Sanitary waste piping exposed to freezing conditions.
  - 4. Stormwater piping exposed to freezing conditions.
  - 5. Roof drains and rainwater leaders.
  - 6. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
  - 1. Section 220716 "Plumbing Equipment Insulation."

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.04 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

## **PART 2 - PRODUCTS**

### **2.01 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Knauf Insulation.
    - c. Manson Insulation Inc.
    - d. Owens Corning.
  2. Type I, 850 Deg. F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### **2.02 INSULATING CEMENTS**

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Ramco Insulation, Inc.

### **2.03 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
- C. PVC Jacket Adhesive: Compatible with PVC jacket.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.

- c. P.I.C. Plastics, Inc.
- d. Speedline Corporation.

## 2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Foster Brand; H. B. Fuller Construction Products.
    - b. Knauf Insulation.
    - c. Vimasco Corporation.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg. F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Knauf Insulation.
    - e. Mon-Eco Industries, Inc.
    - f. Vimasco Corporation.
  - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg. F.
  - 4. Solids Content: 60 percent by volume and 66 percent by weight.
  - 5. Color: White.

## 2.05 SEALANTS

- A. Joint Sealants for Cellular-Glass Products:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
    - e. Pittsburgh Corning Corporation.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Permanently flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 100 to plus 300 deg. F.
  - 5. Color: White or gray.

## 2.06 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When

factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.07 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Foster Brand; H. B. Fuller Construction Products.
    - b. Vimasco Corporation.

## 2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. P.I.C. Plastics, Inc.
    - c. Proto Corporation.
    - d. Speedline Corporation.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White or Color-code jackets based on system. Color as selected by Architect.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45 and 90-degree, short and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pittsburgh Corning Corporation.
    - b. Polyguard Products, Inc.

## 2.09 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.

- c. Ideal Tape Co., Inc., an American Biltrite Company.
  - d. Knauf Insulation.
  - e. Venture Tape.
- 2. Width: 3 inches.
- 3. Thickness: 11.5 mils.
- 4. Adhesion: 90 ounces' force/inch in width.
- 5. Elongation: 2 percent.
- 6. Tensile Strength: 40 lbf/inch in width.
- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Compac Corporation.
    - b. Ideal Tape Co., Inc., an American Biltrite Company.
    - c. Venture Tape.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces' force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.

## 2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ITW Insulation Systems; Illinois Tool Works, Inc.
    - b. RPR Products, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. C & F Wire.

## 2.11 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Engineered Brass Company.
    - b. Insul-Tect Products Co.
    - c. McGuire Manufacturing.
    - d. Plumberex Specialty Products, Inc.
    - e. Truebro.
    - f. Zurn Industries, LLC.
  - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

- B. Protective Shielding Piping Enclosures
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Truebro.
    - b. Zurn Industries, LLC.
  - 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

#### **3.02 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1 ½ - inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.



4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers,

- valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.05 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  4. For insulation with factory applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.

### 3.06 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1 ½ -inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.07 FINISHES

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

### 3.08 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.09 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
  2. Underground piping.
  3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

	Temp	Up to 1"	Up to 1.5"	Up to 4"	Up to 8"	8" & Up
<b>1. Hot Water</b>						
a) Domestic HW/HWR	100-130	1"	1"	1.5"	1.5"	1.5"

- B. Domestic Cold Water
1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Stormwater and Overflow: Insulation shall be one of the following:
1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:
1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:
1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

### 3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
1. PVC: 20 mils thick.
  2. Aluminum, Smooth 0.016 inch thick.
- D. Piping, Exposed:

1. None.
2. PVC: 20 mils thick.
3. Aluminum, Smooth: 0.016 inch thick.

3.12 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

**SECTION 22 11 16 - DOMESTIC WATER PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Copper tube and fittings.
  - 2. Ductile-iron pipe and fittings.
  - 3. Piping joining materials.
  - 4. Transition fittings.
  - 5. Dielectric fittings.
- B. Related Requirements:
  - 1. Section 221113 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water service piping enters the building.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For transition fittings and dielectric fittings.
- B. Sustainable Design Submittals:

**1.03 INFORMATIONAL SUBMITTALS**

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

**PART 2 - PRODUCTS****2.01 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- C. Comply with NSF Standard 372 for low lead.

**2.02 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:

1. MSS SP-123.
  2. Cast-copper-alloy, hexagonal-stock body.
  3. Ball-and-socket, metal-to-metal seating surfaces.
  4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
1. Fittings for NPS 2-inch and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  2. Fittings for NPS 2 ½ to NPS 4-inch: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

## 2.03 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe:
1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:
1. AWWA C110/A21.10, ductile or gray iron.
  2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:
1. AWWA C153/A21.53, ductile iron.
  2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

## 2.04 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  2. Full face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM 656.
- H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.05 TRANSITION FITTINGS

- A. General Requirements:
1. Same size as pipes to be joined.
  2. Pressure rating at least equal to pipes to be joined.
  3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

- C. Plastic-to-Metal Transition Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Charlotte Pipe and Foundry Company.
    - b. Harvel Plastics, Inc.
    - c. Spears Manufacturing Company.
    - d. Uponor.
  2. Description:
    - a. CPVC or PVC one piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Colonial Engineering, Inc.
    - b. NIBCO INC.
    - c. Spears Manufacturing Company.
  2. Description:
    - a. CPVC or PVC four-part union.
    - b. Brass or stainless steel threaded end.
    - c. Solvent-cement-joint or threaded plastic end.
    - d. Rubber O-ring.
    - e. Union nut.

## 2.06 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Central Plastics Company.
    - b. Jomar Valve.
    - c. Matco-Norca.
    - d. Watts; a Watts Water Technologies company.
    - e. Wilkins.
    - f. Zurn Industries, LLC.
  2. Standard: ASSE 1079.
  3. Pressure Rating: 125 psig minimum at 180 deg. F.
  4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Matco-Norca.
    - d. Watts; a Watts Water Technologies company.
    - e. Wilkins.
    - f. Zurn Industries, LLC.



2. Standard: ASSE 1079.
  3. Factory-fabricated, bolted, companion-flange assembly.
  4. Pressure Rating: 125 psig minimum at 180 deg. F.
  5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  2. Nonconducting materials for field assembly of companion flanges.
  3. Pressure Rating: 150 psig
  4. Gasket: Neoprene or phenolic.
  5. Bolt Sleeves: Phenolic or polyethylene.
  6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elster Perfection Corporation.
    - b. Grinnell Mechanical Products.
    - c. Matco-Norca.
    - d. Precision Plumbing Products.
    - e. Victaulic Company.
  2. Standard: IAPMO PS 66.
  3. Electroplated steel nipple complying with ASTM F 1545.
  4. Pressure Rating and Temperature: 300 psig at 225 deg. F.
  5. End Connections: Male threaded or grooved.
  6. Lining: Inert and noncorrosive, propylene.

### **PART 3 - EXECUTION**

#### **3.01 EARTHWORK**

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

#### **3.02 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve

inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- G. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- S. Install thermostats in hot water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
- T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.03 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and

restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Braze Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

#### 3.04 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
1. Fittings for NPS 1 ½ -inch and Smaller: Fitting-type coupling.
  2. Fittings for NPS 2-inch and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 inch and Smaller: Plastic-to-metal transition fittings or unions.

#### 3.05 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2-inch and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2 ½ -inch to NPS 4-inch: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5-inch and Larger: Use dielectric flange kits.

#### 3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
1. Vertical Piping: MSS Type 8 or 42, clamps.
  2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 3/4 -inch and Smaller: 60 inches with 3/8-inch rod.

2. NPS 1-inch and NPS 1 ¼ -inch: 72 inches with 3/8-inch rod.
  3. NPS 1 ½ -inch and NPS 2-inch: 96 inches with 3/8-inch rod.
  4. NPS 2 ½ -inch: 108 inches with 1/2-inch rod.
  5. NPS 3 to NPS 5-inch: 10 feet with 1/2-inch rod.
  6. NPS 6-inch: 10 feet with 5/8-inch rod.
  7. NPS 8-inch: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1 ¼ -inch and Smaller: 84 inches with 3/8-inch rod.
  2. NPS 1 1/2 -inch: 108 inches with 3/8-inch rod.
  3. NPS 2-inch: 10 feet with 3/8-inch rod.
  4. NPS 2 ½ -inch: 11 feet with 1/2-inch rod.
  5. NPS 3-inch and NPS 3 ½ inch: 12 feet with 1/2-inch rod.
  6. NPS 4-inch and NPS 5-inch: 12 feet with 5/8-inch rod.
  7. NPS 6-inch: 12 feet with 3/4-inch rod.
  8. NPS 8-inch to NPS 12-inch: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

### 3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2 ½ -inch and larger.

### 3.08 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### 3.09 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
    - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
  - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.
  - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
  - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
  - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.10 ADJUSTING

- A. Perform the following adjustments before operation:
- 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3-inch and smaller, shall be one of the following:
  - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed copper pressure-seal fittings; and pressure-sealed joints.
  - 2. PVC, Schedule 80; socket fittings; and solvent-cemented joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4-inch to NPS 8-inch and larger, shall be one of the following:
  - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A) ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.
  - 2. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
- F. Under-building-slab, domestic water piping, NPS 2-inch and smaller shall be one of the following:
  - 1. Hard or soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed copper pressure-seal-joint fittings; and pressure-sealed joints.
- G. Aboveground domestic water piping, NPS 2-inch and smaller shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast or wrought-copper, solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.

3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper push-on-joint fittings; and push-on joints.
- H. Aboveground domestic water piping, NPS 2 ½ - to NPS 4-inch shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast or wrought copper, solder-joint fittings; and soldered joints.
  2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
  3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); grooved-joint, copper-tube appurtenances; and grooved joints.

END OF SECTION

**SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Water pressure-reducing valves.
  - 4. Balancing valves.
  - 5. Temperature-actuated, water mixing valves.
  - 6. Strainers.
  - 7. Hose bibbs.
  - 8. Wall hydrants.
  - 9. Drain valves.
  - 10. Water-hammer arresters.
  - 11. Trap-seal primer valves.
- B. Related Requirements:
  - 1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
  - 2. Section 221116 "Domestic Water Piping" for water meters.
  - 3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
  - 4. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
  - 5. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.

**1.02 ACTION SUBMITTALS**

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

**1.03 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**PART 2 - PRODUCTS****2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- A. Potable-water piping and components shall comply with NSF 61 Annex G.



## 2.02 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

## 2.03 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers
1. Standard: ASSE 1001.
  2. Size: NPS 1/4-inch to NPS 3-inch, as required to match connected piping.
  3. Body: Bronze.
  4. Inlet and Outlet Connections: Threaded.
  5. Finish: Rough bronze or Chrome plated.
- B. Hose-Connection Vacuum Breakers
1. Standard: ASSE 1011.
  2. Body: Bronze, nonremovable, with manual drain.
  3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  4. Finish: Chrome or nickel plated.

## 2.04 BACKFLOW PREVENTERS

- A. Intermediate Atmospheric-Vent Backflow Preventers
1. Standard: ASSE 1012.
  2. Operation: Continuous-pressure applications.
  3. Size: NPS 1/2-inch.
  4. Body: Bronze.
  5. End Connections: Union, solder joint.
  6. Finish: Rough bronze.
- B. Reduced-Pressure-Principle Backflow Preventers
1. Standard: ASSE 1013.
  2. Operation: Continuous-pressure applications.
  3. Pressure Loss: 12 psig maximum, through middle third of flow range.
  4. Body: Bronze for NPS 2-inch and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved NPS 2 ½ -inch and larger.
  5. End Connections: Threaded for NPS 2-inch and smaller; flanged for NPS 2 ½ -inch and larger.
  6. Configuration: Designed for horizontal, straight-through or vertical flow.
  7. Accessories:
    - a. Valves NPS 2-inch and Smaller: Ball type with threaded ends on inlet and outlet.
    - b. Valves NPS 2 ½ -inch and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
- C. Double-Check, Backflow-Prevention Assemblies
1. Standard: ASSE 1015.
  2. Operation: Continuous-pressure applications unless otherwise indicated.
  3. Pressure Loss: 5 psig maximum, through middle third of flow range.
  4. Body: Bronze for NPS 2-inch and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2 ½ -inch and larger.
  5. End Connections: Threaded for NPS 2 inch and smaller; flanged for NPS 2 ½ -inch

- and larger.
- 6. Configuration: Designed for horizontal, straight-through flow.
- 7. Accessories:
  - a. Valves NPS 2-inch and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2 ½ -inch and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

## 2.05 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. Honeywell Water Controls.
    - c. Watts; a Watts Water Technologies company.
    - d. Zurn Industries, LLC.
  - 2. Standard: ASSE 1003.
  - 3. Pressure Rating: Initial working pressure of 150 psig.
  - 4. Body: Bronze with chrome-plated finish for NPS 2-inch and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2 ½ -inch and NPS 3-inch.
  - 5. Valves for Booster Heater Water Supply: Include integral bypass.
  - 6. End Connections: Threaded for NPS 2-inch and smaller; flanged for NPS 2 ½ -inch and NPS 3-inch.

## 2.06 BALANCING VALVES

- A. Memory-Stop Balancing Valves
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. Jenkins Valves; Crane Energy Flow Solutions.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
    - e. Stockham; Crane Energy Flow Solutions.
  - 2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
  - 3. Pressure Rating: 400-psig minimum CWP.
  - 4. Size: NPS 2-inch or smaller.
  - 5. Body: Copper alloy.
  - 6. Port: Standard or full port.
  - 7. Ball: Chrome-plated brass.
  - 8. Seats and Seals: Replaceable.
  - 9. End Connections: Solder joint or threaded.
  - 10. Handle: Vinyl-covered steel with memory-setting device.

## 2.07 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Water-Temperature Limiting Devices
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Apollo Valves; Conbraco Industries, Inc.
    - b. Armstrong International, Inc.
    - c. Honeywell Water Controls.
    - d. Leonard Valve Company.
    - e. Powers.
    - f. Symmons Industries, Inc.
    - g. TACO Incorporated.
    - h. Watts; a Watts Water Technologies company.
    - i. Zurn Industries, LLC.
  2. Standard: ASSE 1017.
  3. Pressure Rating: 125 psig.
  4. Type: Thermostatically controlled, water mixing valve.
  5. Material: Bronze body with corrosion-resistant interior components.
  6. Connections: Threaded inlets and outlet.
  7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
  8. Valve Finish: Rough bronze.
- B. Primary, Thermostatic, Water Mixing Valves
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong International, Inc.
    - b. Lawler Manufacturing Company, Inc.
    - c. Leonard Valve Company.
    - d. Powers.
    - e. Symmons Industries, Inc.
    - f. Zurn Industries, LLC.
  2. Standard: ASSE 1017.
  3. Pressure Rating: 125 psig minimum unless otherwise indicated.
  4. Type: Thermostatically controlled, water mixing valve.
  5. Material: Bronze body with corrosion-resistant interior components.
  6. Connections: Threaded union inlets and outlet.
  7. Accessories: Manual temperature control, check stops on hot and cold water supplies, and adjustable, temperature-control handle.
  8. Valve Finish: Chrome plated.
  9. Piping Finish: Chrome plated.
  10. Cabinet: Factory fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.

## 2.08 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers
1. Pressure Rating: 125 psig minimum unless otherwise indicated.
  2. Body: Bronze for NPS 2 inch and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2 ½ - inch and larger.
  3. End Connections: Threaded for NPS 2 inch and smaller; flanged for NPS 2 ½ - inch and larger.
  4. Screen: Stainless steel with round perforations unless otherwise indicated.
  5. Perforation Size:
    - a. Strainers NPS 2-inch and Smaller: 0.020 inch.
    - b. Strainers NPS 2 ½ -inch to NPS 4-inch: 0.045 inch.

- c. Strainers NPS 5-inch and Larger: 0.10 inch.
- 6. Drain: Pipe plug.

## 2.09 HOSE BIBBS

### A. Hose Bibbs

- 1. Standard: ASME A112.18.1 for sediment faucets.
- 2. Body Material: Bronze.
- 3. Seat: Bronze, replaceable.
- 4. Supply Connections: NPS 1/2-inch or NPS 3/4-inch threaded or solder-joint inlet.
- 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
- 6. Pressure Rating: 125 psig.
- 7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
- 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
- 9. Finish for Service Areas: Rough bronze.
- 10. Finish for Finished Rooms: Chrome or nickel plated.
- 11. Operation for Equipment Rooms: Wheel handle or operating key.
- 12. Operation for Service Areas: Wheel handle.
- 13. Operation for Finished Rooms: Wheel handle.
- 14. Include operating key with each operating-key hose bibb.
- 15. Include integral wall flange with each chrome or nickel plated hose bibb.

## 2.10 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants

- 1. Standard: ASME A112.21. 3M for concealed or exposed-outlet, self-draining wall hydrants.
- 2. Pressure Rating: 125 psig.
- 3. Operation: Loose key.
- 4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
- 5. Inlet: NPS 3/4-inch or NPS 1-inch.
- 6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
- 7. Box: Deep, flush mounted with cover.
- 8. Box and Cover Finish: Polished nickel bronze.
- 9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
- 10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
- 11. Operating Keys(s): One with each wall hydrant.

### B. Nonfreeze, Hot- and Cold-Water Wall Hydrants

- 1. Standard: ASME A112.21. 3M for concealed or exposed-outlet, self-draining wall hydrants.
- 2. Pressure Rating: 125 psig
- 3. Operation: Loose key.
- 4. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
- 5. Inlet: NPS 3/4-inch or NPS 1-inch.
- 6. Outlet: Concealed.
- 7. Box: Deep, flush mounted with cover.

8. Box and Cover Finish: Polished nickel bronze.
  9. Vacuum Breaker:
    - a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
  10. Operating Keys: One with each wall hydrant.
- C. Vacuum Breaker Wall Hydrants
1. Standard: ASSE 1019, Type A or Type B.
  2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
  3. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
  4. Pressure Rating: 125 psig.
  5. Operation: Loose key or wheel handle.
  6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
  7. Inlet: NPS 1/2-inch or NPS 3/4-inch.
  8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

## 2.11 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
  2. Pressure Rating: 400-psig minimum CWP.
  3. Size: NPS 3/4-inch.
  4. Body: Copper alloy.
  5. Ball: Chrome-plated brass.
  6. Seats and Seals: Replaceable.
  7. Handle: Vinyl-covered steel.
  8. Inlet: Threaded or solder joint.
  9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.12 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg. Co.
    - b. Josam Company.
    - c. Precision Plumbing Products.
    - d. Sioux Chief Manufacturing Company, Inc.
    - e. Watts; a Watts Water Technologies company.
    - f. Zurn Industries, LLC.
  2. Standard: ASSE 1010 or PDI-WH 201.
  3. Type: Copper tube with piston.
  4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## 2.13 TRAP-SEAL PRIMER DEVICE

- A. Supply-Type, Trap-Seal Primer Device

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg. Co.
    - b. Precision Plumbing Products.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Watts; a Watts Water Technologies company.
    - e. Zurn Industries, LLC.
  2. Standard: ASSE 1018.
  3. Pressure Rating: 125 psig minimum.
  4. Body: Bronze.
  5. Inlet and Outlet Connections: NPS 1-inch threaded, union, or solder joint.
  6. Gravity Drain Outlet Connection: NPS 1/2-inch threaded or solder joint.
  7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
- B. Drainage-Type, Trap-Seal Primer Device:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Jay R. Smith Mfg. Co.
  2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8-inch minimum, trap makeup connection.
  3. Size: NPS 1 1/4 -inch minimum.
  4. Material: Chrome-plated, cast brass.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air brakes are unacceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- E. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.
- F. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.
- G. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

- H. Install water-hammer arresters in water piping according to PDI-WH 201.
- I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- J. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

### 3.02 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

### 3.03 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.04 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

**SECTION 22 13 00 - DRAINAGE SYSTEMS****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 22 05 00 for requirements which are applicable to this section.
- B. Requirements of the International codes and authorities having jurisdiction shall be made a part of these specifications.
- C. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirement shall be followed.

**1.02 QUALITY ASSURANCE:**

- A. Install piping to meet requirements of International Plumbing Code.
- B. Provide manufacturer's certificate that materials meet or exceed minimum requirements as specified.
- C. All Piping and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

**1.03 SUBMITTALS:**

- A. Certificates: Submit manufacturer's certificates of conformance to applicable codes.
- B. Test Reports: Submit copies of test reports.
- C. Manufacturer's Recommendations: Submit "PVC" manufacturer's materials, installation support and expansion joint recommendations for review by Architect/Engineer.

**PART 2 - PRODUCTS****2.01 PIPE AND FITTINGS**

- A. Polyvinyl Chloride (PVC) Pipe and Fittings: Schedule 40 Solid Wall Pipe DWV drain, waste and vent to be used for all underground storm, sanitary and condensate drainage systems and all vent piping above grade for sanitary systems.
  - 1. Pipe and fittings shall be manufactured from virgin rigid PVC (Polyvinyl chloride) vinyl compounds with a Cell Class of 12454 as identified in ASTM D 1784.
  - 2. PVC Schedule 40 pipe shall be Iron Pipe Size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded PVC DWV fittings shall conform to ASTM D 2665. Fabricated PVC DWV fittings shall conform to ASTM F 1866. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer. All pipe and fittings shall be manufactured in the United States. All systems shall utilize a separate waste and vent system. Pipe and fittings shall conform to NSF International Standard 14.
- B. Exposed drainage systems shall be schedule 40 galvanized steel, copper tube type "L", or standard weight cast iron.



- C. Dishwasher drainage piping to be cast iron no-hub.

## 2.02 CLEANOUTS:

- A. Slab on grade; J. R. Smith 433OV with nickel bronze cover and rim.
- B. Concrete Floors; J. R. Smith 4020 with nickel bronze cover. Provide flashing flange where floor is waterproofed.
- C. Tile Floors; J. R. Smith 4140 with 1/8" recess. Provide flashing flange where floor is waterproofed.
- D. Carpet Floors; J. R. Smith 4020 with carpet marker.
- E. Walls; J. R. Smith 4510-4725 cover plate chrome finish.
- F. Equivalents by Josam, Zurn, Watts and Wade are acceptable.

## 2.03 FLOOR DRAINS

- A. Finished spaces unless otherwise noted on plans; J. R. Smith 2010-A with nickel bronze strainer. Provide trap primer connection and heel proof grate. Flashing collar. In traffic areas provide heel proof strainer.
- B. Unfinished spaces; J. R. Smith 2110 with cast iron grate and flashing flange.

## 2.04 TRAP PRIMERS

- A. Smith No. 2699 cast bronze trap primer with 1/2" connections. Provide primered drains with Smith No. 2695 or 2696 cast iron trap primer adaptors.
- B. Trap primers for multiple floor drains shall consist of the appropriate model with distribution unit as manufactured by Precision Plumbing Products.
- C. All trap primers shall be accessibly located and installed in strict accordance with the manufacturer's recommendations.

## 2.05 ROOF DRAINS

- A. Roof drains shall be a J.R. Smith No. 1010 cast iron roof drain with flashing collar and "fortiflex" plastic or aluminum dome. Furnish extension (suffix E) for insulated roofs. Sump receiver (suffix R) and underdeck clamp (suffix C) for all but pour-in place installations. Ferrous domes not acceptable. Specify vandal-proof dome when required (suffix U).
- B. Overflow roof drains shall be J. R. Smith No. 1070 with dam height set based on the maximum depth of ponding allowed by the design of the roof structure.
- C. Combination roof drain/overflow drain, deck clamp, overflow strainer, drain pan, deck extension, and cast iron. Froet Industries "100C" Series.

# PART 3 - EXECUTION

## 3.01 INSPECTION

- A. Examine areas to receive piping for:
  - 1. Defects that adversely affect execution and quality of work.
  - 2. Deviations beyond allowable tolerance for piping clearances.
- B. Start work only when conditions are satisfactory.

### 3.02 INSTALLATION

#### A. Piping Layout:

1. Complete installation to present a neat, orderly appearance.
2. Do not block openings or passageways with piping.
3. Run piping parallel to walls of building, unless otherwise indicated.
4. Keep piping free from contact with structure or installed items.
5. All changes in direction to be made with "Y" branches or 1/8 bends.
6. Provide cleanouts at base of all stacks, at changes in direction of piping and at 50-foot intervals. Cleanouts shall be line size up to 4 inch and 4 inch for piping over 4 inch.

#### B. Workmanship:

1. Examine pipe and fittings before installation and assure no defective materials are incorporated.
2. Keep inside of pipes and fittings free of dirt and debris.
3. Installation of cast iron soil pipe to conform to Cast Iron Soil Pipe Institute Standards Handbook.

#### C. Placement:

1. Vertical Piping:
  - a. Secure at sufficiently close intervals to keep pipe in alignment, and to support weight of pipe and contents.
  - b. Install risers, stacks, etc. as directly as possible to roof.
  - c. Install supports at each floor.
2. Horizontal Piping, Suspended;
  - a. Support at sufficiently close intervals to prevent sagging and to maintain alignment. Not to exceed: cast iron piping to be supported at pipe joints not to exceed 10'-0" spacing. Copper and steel piping to be supported on 12' spacing. PVC piping to be supported on 4'-0" spacing. Copper tubing up to 1 1/4" to be supported on 6' spacing, over 1 1/4" to be supported on 10'-0" spacing. Other piping to be supported per manufacturer.
  - b. Install hangers and supports at least 18 inches from each joint regardless of pipe length.
  - c. Install hangers at the ends of all runs or branches and at each change of direction or alignment.
  - d. Gasketed or mechanical joints piping shall be securely braced, or clamp and rod restrained to prevent horizontal movement where the transition from the vertical of the horizontal occurs. Branches must be secured to prevent movement in any direction by use of sway bracing.
3. Horizontal Piping, Underground;
  - a. Lay piping on firm bed for entire length of trench except where supports are provided.
  - b. Employ partial backfilling and cradling to hold pipe in secure position during backfilling operations.
  - c. Firmly brace piping laid on grade prior to embedment in concrete.
4. PVC and DWV Schedule 40:
  - a. PVC pipe installation practices including support bracing and solvent welding shall be in strict conformance with the manufacturer's recommendations.
  - b. Expansion joints shall be installed at every floor for waste and soil system stack, alternate floors for vent stacks rainwater conductors and condensate stacks.

3.03 TESTING

- A. Disconnect all equipment and devices which may be damaged by test pressures.
- B. Plug or cap lines.
- C. Test each piping system for leaks in accordance with the local inspector's test code.
- D. Repair all leaks noted.
- E. Minimum test shall be to fill system to top vent stack and not show a drop of more than 3 inches for 1 hour. Test shall be performed before piping is concealed.
- F. Secure certificate from municipal inspector of an acceptable test.

END OF SECTION

**SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

**1.03 INFORMATIONAL SUBMITTALS**

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
- B. Field quality-control reports.

**PART 2 - PRODUCTS****2.01 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

**2.02 PIPING MATERIALS**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

**2.03 PVC PIPE AND FITTINGS**

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Adhesive Primer: ASTM F 656.
- E. Solvent Cement: ASTM D 2564.

## 2.04 SPECIALTY PIPE FITTINGS

### A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:
  - a. Manufacturers:
    - 1) Fernco Inc
    - 2) Froet Industries LLC
    - 3) Plastic Oddities
  - b. Standard: ASTM C 1173.
  - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - d. End Connections: Same size as and compatible with pipes to be joined.
  - e. Sleeve Materials:
    - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
    - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - 3) For Dissimilar Pipes: ASTM D 5926, PVC, or other material compatible with pipe materials being joined.
3. Shielded, Nonpressure Transition Couplings:
  - a. Manufacturers:
    - 1) Cascade Waterworks Mfg.
    - 2) Mission Rubber Co.
  - b. Standard: ASTM C 1460.
  - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - d. End Connections: Same size as and compatible with pipes to be joined.

## PART 3 - EXECUTION

### 3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

### 3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
  - 2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back-to-back or side by side with common drainpipe.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.
  - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  - 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- O. Install aboveground PVC piping according to ASTM D 2665.
- P. Install underground PVC piping according to ASTM D 2321.
- Q. Plumbing Specialties:
  - 1. Install backwater valves in sanitary waster gravity-flow piping.
    - a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    - a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 3. Install drains in sanitary waste gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and

## Sleeve Seals for Plumbing Piping."

- T. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

## 3.03 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipes and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

## 3.04 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in ODs.
  - 2. In Waste Drainage Piping: Unshielded nonpressure transition couplings.

## 3.05 VALVE INSTALLATION

- A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.
- B. Shutoff Valves:
  - 1. Install shutoff valve on each sewage pump discharge.
  - 2. Install gate or full-port ball valve for piping NPS 2 and smaller.
  - 3. Install gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
  - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
  - 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
  - 3. Install backwater valves in accessible locations.
  - 4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

## 3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment." Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel fiberglass pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- F. Install supports for vertical PVC piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

### 3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Install horizontal backwater valves with cleanout cover flush with floor.
  - 6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 7. Equipment: Connect waste piping as indicated.
    - a. Provide shutoff valve if indicated and union for each connection.



- b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.08 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.09 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
    - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    - d. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof,

- until satisfactory results are obtained.
- 6. Prepare reports for tests and required corrective action.

### 3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

### 3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- F. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
  - 1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION

**SECTION 22 13 19.13 - SANITARY DRAINS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Floor drains.
  - 2. Trench drains.

**1.02 DEFINITIONS**

- A. FRP: Fiberglass-reinforced plastic.
- B. HDPE: High-density polyethylene.
- C. PE: Polyethylene.
- D. PP: Polypropylene.
- E. PVC: Polyvinyl chloride.

**1.03 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 DRAIN ASSEMBLIES**

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary piping specialty components.

**2.02 FLOOR DRAINS**

- A. Cast-Iron Floor Drains:
  - 1. Manufacturers:
    - a. Jay R Smith Mfg. Co.
    - b. Josam Co.
    - c. MIFAB, Inc
    - d. Sioux Chief Manufacturing
    - e. Wade
    - f. WATTS
    - g. Zurn Industries, LLC
  - 2. Standard: ASME A112.6.3.
  - 3. Pattern: Area Floor, Funnel floor drain.
  - 4. Body Material: Gray iron.
  - 5. Outlet: Bottom Side.

6. Top or Strainer Material: Bronze.
  7. Top of Body and Strainer Finish: Nickel bronze.
  8. Top Shape: Round Square.
  9. Trap Material: Bronze.
  10. Trap Pattern: Standard P-trap.
  11. Trap Features: Cleanout.
- B. Plastic Floor Drains:
1. Manufacturers:
    - a. Josam Co.
    - b. Oatey
    - c. Plastic Oddities
    - d. Sioux Chief Manufacturing
    - e. Zurn Industries, LLC
  2. Standard: ASME A112.6.3.
  3. Material: PVC.
  4. Outlet: Bottom Side.
  5. Top or Strainer Material: Bronze.
  6. Top of Body and Strainer Finish: Nickel bronze.
  7. Top Shape: Round Square.
  8. Trap Material: Plastic drainage piping.
  9. Trap Pattern: Standard P-trap.

## 2.03 TRENCH DRAINS

- A. Trench Drains:
1. Manufacturers:
    - a. Jay R Smith Mfg. Co.
    - b. Josam Co.
    - c. MIFAB, Inc
    - d. Sioux Chief Manufacturing
    - e. Wade
    - f. WATTS
    - g. Zurn Industries, LLC
  2. Standard: ASME A112.6.3 for trench drains.
  3. Material: Ductile or gray iron.
  4. Flange: Anchor.
  5. Clamping Device: Required.
  6. Outlet: Bottom End Side.
  7. Grate Material: Ductile iron or gray iron.
  8. Trap Material: Cast iron.
  9. Trap Pattern: Standard P-trap.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
  3. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
    - a. Maintain integrity of waterproof membranes where penetrated.
  5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install trench drains at low points of surface areas to be drained.
1. Set grates of drains flush with finished surface, unless otherwise indicated.
  2. Install on support devices, so that top will be flush with adjacent surface.
- C. Install open drain fittings with top of hub 1 inch (25 mm) above floor.

### 3.02 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.
- D. Install piping adjacent to equipment to allow service and maintenance.
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

### 3.03 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.04 PROTECTION

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

END OF SECTION

**SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Roof flashing assemblies.
  - 3. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
  - 1. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
  - 2. Section 224300 "Healthcare Plumbing Fixtures" for plaster sink interceptors.
  - 3. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping and piping specialties outside the building.

**1.02 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. PVC: Polyvinyl chloride.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**PART 2 - PRODUCTS****2.01 ASSEMBLY DESCRIPTIONS**

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

**2.02 CLEANOUTS**

- A. Cast-Iron Exposed Cleanouts:
  - 1. Manufactures:
    - a. Jay R. Smith Mfg. Co.
    - b. Josam Co.
    - c. MIFAB, Inc

- d. Tyler Pipe
  - e. WATTS
  - f. Zurn Industries, LLC
- 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
- 3. Size: Same as connected drainage piping
- 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
- 5. Closure: Countersunk or raised head, **brass** plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 7. Closure: Stainless-steel plug with seal.
- B. Cast-Iron Exposed Floor Cleanouts:
  - 1. Manufacturers:
    - a. Jay R. Smith Mfg.; Co.
    - b. Josam Co.
    - c. MIFAB, Inc
    - d. Sioux Chief Manufacturing
    - e. Zurn Industries, LLC
  - 2. Standard: ASME A112.36.2M for adjustable housing cleanout.
  - 3. Size: Same as connected branch.
  - 4. Type: Adjustable housing.
  - 5. Body or Ferrule: Cast iron.
  - 6. Clamping Device: Not required.
  - 7. Outlet Connection: Inside calk.
  - 8. Closure: Brass plug with straight threads and gasket.
  - 9. Adjustable Housing Material: Cast iron Plastic with threads setscrews or other device.
  - 10. Frame and Cover Shape: Round.
  - 11. Top Loading Classification: Extra Heavy Duty.
  - 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to clean out.
- C. Cast-Iron Wall Cleanouts
  - 1. Manufacturers:
    - a. Jay R. Smith Mfg.; Co.
    - b. Josam Co.
    - c. MIFAB, Inc
    - d. Sioux Chief Manufacturing
    - e. Zurn Industries, LLC
  - 2. Standard: ASME A112.36.2M. Include wall access.
  - 3. Size: Same as connected drainage piping.
  - 4. Body: Hub-and-spigot, cast-iron soil pipe T-branch Hubless, cast-iron soil pipe test tee as required to match connected piping.
  - 5. Closure Plug:
    - a. Brass or Cast iron.
    - b. Countersunk or raised head.
    - c. Drilled and threaded for cover attachment screw.
    - d. Size: Same as or not more than one size smaller than cleanout size.
  - 6. **Wall Access: Round, deep, chrome-plated bronze cover plate with screw.**
- D. Plastic Floor Cleanouts:
  - 1. Manufacturers:
    - a. Endura
    - b. Plastic Oddities
    - c. Sioux Chief Manufacturing

- d. Zurn Industries, LLC
2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.
5. Riser: Drainage pipe fitting and riser to clean out of same material as drainage piping.

## 2.03 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
1. Manufacturers:
    - a. Acorn Engineering Co.
    - b. Thaler Metal Industries
    - c. Zurn Industries
  2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
    - a. Open-Top Vent Cap: Without cap.
    - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
    - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

## 2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
  2. Size: Same as connected waste piping.
- B. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
  2. Size: Same as connected waste piping.
    - a. NPS 2: 4-inch- minimum water seal.
    - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Floor-Drain, Trap-Seal Primer Fittings:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
  2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
- D. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
  2. Body: Bronze or cast iron.
  3. Inlet: Opening in top of body.
  4. Outlet: Larger than inlet.
  5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- E. Sleeve Flashing Device:
1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
  2. Size: As required for close fit to riser or stack piping.



- F. Stack Flashing Fittings:
  - 1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
  - 2. Size: Same as connected stack vent or vent stack.
- G. Vent Caps:
  - 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
  - 2. Size: Same as connected stack vent or vent stack.
- H. Expansion Joints:
  - 1. Standard: ASME A112.6.4.
  - 2. Body: Cast iron with bronze sleeve, packing, and gland.
  - 3. End Connections: Matching connected piping.
  - 4. Size: Same as connected soil, waste, or vent piping.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Assemble open drain fittings and install with top of hub 2 inches above floor.
- E. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- H. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- I. Install vent caps on each vent pipe passing through roof.
- J. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- K. Install wood-blocking reinforcement for wall-mounting-type specialties.
- L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

#### **3.02 CONNECTIONS**

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

### 3.04 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
  - 1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.05 PROTECTION

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

END OF SECTION

**SECTION 22 13 23 - SANITARY WASTE INTERCEPTORS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Solids interceptors.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of interceptor.
- B. Shop Drawings: For each type and size of precast concrete interceptor indicated.
  - 1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Interceptors, drawn to scale, and coordinated with each other, using input from installers of the items involved:
  - 1. Piping connections. Include size, location, and elevation of each.
  - 2. Interface with underground structures and utility services.

**PART 2 - PRODUCTS****2.01 SOLIDS INTERCEPTORS**

- A. Cast-Iron or Steel Solids Interceptors:
  - 1. Manufacturers:
    - a. Jay R Smith Mfg. Co.
    - b. Josam Co.
    - c. MIFAB, Inc
    - d. Rockford Sanitary Systems
    - e. WATTS
    - f. Zurn Industries, LLC
  - 2. Type: Factory-fabricated interceptor made for removing and retaining lint or sediment from wastewater.
  - 3. Body Material: Cast iron or steel.
  - 4. Interior Separation Device: Baffles or Screens.
  - 5. Interior Lining: Corrosion-resistant enamel.
  - 6. Exterior Coating: Corrosion-resistant enamel.

**PART 3 - EXECUTION**

### 3.01 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

### 3.02 INSTALLATION

- A. Equipment Mounting:
  - 1. Install grease interceptors, grease removal devices, and solids interceptors on cast-in-place concrete equipment base(s).
- B. Install precast concrete interceptors according to ASTM C 891.
- C. Set interceptors level and plumb.
- D. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.
- E. Set tops of manhole frames and covers flush with finished surface in pavements.
- F. Set tops of grating frames and grates flush with finished surface.
- G. Set metal interceptors level and plumb.
- H. Set tops of metal interceptor covers flush with finished surface in pavements.
- I. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
  - 1. Above-Floor Installation: Set unit with bottom resting on floor unless otherwise indicated.
  - 2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
  - 3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
  - 4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- J. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction.
  - 1. Install control panel adjacent to unit unless otherwise indicated.
- K. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
- L. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet.
  - 1. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

### 3.03 CONNECTIONS

- A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors and piping systems.

### 3.04 IDENTIFICATION

- A. Identification materials and installation are specified in Section 312000 "Earth Moving."
  - 1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
  - 2. Use warning tapes or detectable warning tape over ferrous piping.
  - 3. Use detectable warning tape over nonferrous piping and over edges of underground structures.

- B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Grease interceptors.
  2. Grease removal devices.
  3. Oil interceptors.
  4. Solids interceptors.

END OF SECTION

**SECTION 22 14 13 - FACILITY STORM DRAINAGE PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
- B. Related Section:
  - 1. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:

**1.03 INFORMATIONAL SUBMITTALS**

- A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
- B. Field quality-control reports.

**1.04 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

**PART 2 - PRODUCTS****2.01 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

**2.02 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

**2.03 PVC PIPE AND FITTINGS**

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
- D. Solvent Cement: ASTM D 2564.

**2.04 SPECIALTY PIPE FITTINGS**

- A. Transition Couplings:
  - 1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
  - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
  - 3. Unshielded, Nonpressure Transition Couplings:
    - a. Manufacturers
      - 1) Fernco, Inc
      - 2) Plastic Oddities
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
  - 4. Shielded, Nonpressure Transition Couplings:
    - a. Manufacturers:
      - 1) Cascade Waterworks Mfg. Co.
      - 2) Mission Rubber Co.
    - b. Standard: ASTM C 1460.
    - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

**PART 3 - EXECUTION****3.01 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

**3.02 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- L. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- M. Install aboveground PVC piping according to ASTM D 2665.
- N. Install underground PVC piping according to ASTM D 2321.
- O. Plumbing Specialties:
  - 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
  - 3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."



- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.03 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasketed joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- E. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendices.

### 3.04 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in ODs.
  - 2. In Drainage Piping: Unshielded, nonpressure transition couplings.

### 3.05 VALVE INSTALLATION

- A. Backwater Valves: Install backwater valves in piping subject to backflow.
  - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
  - 2. Install backwater valves in accessible locations.
  - 3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

### 3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel or fiberglass pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Individual, Straight, Horizontal Piping Runs:

- a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
  - c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  5. NPS 6: 10 feet with 5/8-inch rod.
  6. NPS 8: 10 feet with 3/4-inch rod.
- I. Install supports for vertical copper tubing every 10 feet.
- J. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  2. NPS 3: 48 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- K. Install supports for vertical ABS and PVC piping every 48 inches.
- L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
  1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
  2. Install horizontal backwater valves with cleanout cover flush with floor or in pit with pit cover flush with floor.
  3. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 221423 "Storm Drainage Piping Specialties."

- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

### 3.08 IDENTIFICATION

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.09 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.

### 3.10 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.

3. Copper DWV tube, copper drainage fittings, and soldered joints.
  4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Aboveground, storm drainage piping NPS 8 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.
  3. Copper DWV tube, copper drainage fittings, and soldered joints.
  4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Underground storm drainage piping NPS 6 and smaller shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints.
- 
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Underground, storm drainage piping NPS 8 and larger shall be any of the following:
1. Extra Heavy Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, or cast-iron, hubless-piping couplings; and coupled joints.
  3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION

**SECTION 22 33 00 – ELECTRIC, DOMESTIC WATER HEATERS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Commercial, light-duty, storage, electric, domestic-water heaters.
  - 2. Domestic-water heater accessories.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. Sustainable Design Submittals:
- C. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Retain first paragraph below if plumbing codes for Project area require domestic-water heaters to be independent-testing-agency certified. Verify availability for units retained.
- B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**1.05 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1 2016.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex, "Drinking Water System Components - Health Effects."

**1.06 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

- B. Verify available warranties and warranty periods for units and components with manufacturers listed in Part 2 articles.
  - 1. Warranty Periods: From date of Substantial Completion.
    - a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
      - 1) Storage Tank: Five years.
      - 2) Controls and Other Components: Three years.
    - b. Compression Tanks: Five years.

## PART 2 - PRODUCTS

### 2.01 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
  - 1. Manufacturers:
    - a. A.O. Smith Corp
    - b. Bradford White Corp
    - c. Lochinvar LLC
    - d. Rheem Manufacturing Co.
    - e. State Industries
  - 2. Standard: UL 174.
  - 3. Storage-Tank Construction: Steel, vertical arrangement.
    - a. Tappings: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 150 psig.
    - c. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending lining material into tappings.
  - 4. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    - c. Drain Valve: ASSE 1005.
    - d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
    - e. Jacket: Steel with enameled finish.
    - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    - g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation unless otherwise indicated. Limited to 12 kW total.
    - h. Temperature Control: Adjustable thermostat.
    - i. Safety Control: High-temperature-limit cutoff device or system.
    - j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

### 2.02 DOMESTIC-WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
  - 1. Manufacturers:
    - a. A.O. Smith Corp
    - b. AMTROL, Inc.

- c. Honeywell International
  - d. State Industries
  - e. Taco Comfort Solutions
- 2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
- 3. Construction:
  - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
  - b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Air-Charging Valve: Factory installed.
  - d. If more than one compression tank is required on Project, delete subparagraph below and schedule compression tanks on Drawings.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig maximum outlet pressure unless otherwise indicated.
- F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- G. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.
- H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- I. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- J. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- K. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

### 2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in architectural specifications.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.01 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base.
1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform.
  2. Maintain manufacturer's recommended clearances.
  3. Arrange units so controls and devices that require servicing are accessible.
  4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  7. Install anchor bolts to elevations required for proper attachment to supported equipment.
  1. Anchor domestic-water heaters to substrate.
- B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping."
- C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- H. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- I. Fill electric, domestic-water heaters with water.
- J. Charge domestic-water compression tanks with air.

### 3.02 CONNECTIONS



- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### 3.03 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in architectural specifications.
- C. Prepare test and inspection reports.

END OF SECTION

**SECTION 22 40 00 - PLUMBING FIXTURES AND EQUIPMENT****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 22 05 00 for requirements which are applicable to this section.
- B. Reference the requirements of the International Plumbing Code.
- C. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

**1.02 WORK INCLUDED**

- A. Furnish and install plumbing fixtures, drains, trim, supplies, fastening devices, carriers, valves, and traps for a complete installation.
- B. Provide connection of all services for soil, waste, vent, cold and hot water.

**1.03 SUBMITTALS**

- A. Submit shop drawings of all materials and products described in this section and indicated on the drawings including that listed in the schedule on the drawings.
- B. Fixture submittals shall include all trim associated with the china. They shall be incorporated in a single brochure with the items being furnished clearly identified.

**1.04 QUALITY ASSURANCE**

- A. All fixtures shall be unmarked, uncracked, true, and level. All shall be warranted to not craze, color, or scale.
- B. Installations shall conform to the International Plumbing Code.
- C. Install all materials and equipment in accordance with the manufacturer's instructions and within the warranty requirements.
- D. All handicapped fixtures and their installation shall conform to the Americans with Disabilities Act and Fair Housing Amendments Act (Public Law 101-336).

**PART 2 - PRODUCTS****2.01 TRAPS**

- A. Fixture traps shall be approved self-cleaning type with clean-outs.
- B. Traps shall be chrome plated cast brass.
- C. Traps for lavatories shall be 1 1/4" x 1 1/2" size.

**2.02 TRIM**

- A. All trim including faucets, waste fittings, strainers, valves, supplies, nipples, and escutcheons shall be chrome plated cast brass.

- B. Exposed water supply pipes shall be chrome plated brass with loose key angle stops.
- C. Fixtures shall be selected for low water consumption and limited to 1.6 gallons per flush on toilets, 2.2 gpm for faucets, and 2.5 gpm for showers.
- D. Public toilet room faucets shall be self-closing metering type when not indicated for the handicapped. Handicapped faucets shall conform to ADA requirements. Provide an approved temperature limiting device that conforms to ASSE 1070.
- E. All lavatories in public toilet rooms shall have grid type strainers.
- F. Waste connections for handicapped lavatories shall be offset. Contractor is to insulate all exposed domestic water and waste piping with prefab PVC jacketed assemblies.
- G. For fixtures requiring flush valves, they shall be of the low consumption type. Selection shall be for use with the specified fixture.
- H. 'Eco-drive' sensor operated flush valves and faucets shall include regenerating battery system.
- I. Water cooler shall have a bottle filler on the low station.

## 2.03 CARRIERS

- A. All wall hung fixtures shall be provided with floor mounted carriers.
- B. Floor mounted carriers shall have short pattern foot supports.
- C. Carriers for lavatories shall be concealed arm type.

## 2.04 MANUFACTURERS

- A. Fixtures; Kohler, American-Standard, Crane.
- B. Seats; Church, Olsonite, Sperzel, Benke, Bemis.
- C. Carriers; Josam, Zurn, Wade, J.R. Smith, Watts.
- D. Faucets; American-Standard, Speakman, Chicago, Kohler, Delta, Moen.
- E. Supplies and Traps; McGuire, Brass Craft, Central Brass, Kohler, American-Standard.
- F. Shower, Mop Receptors and Laundry Trays; Crane/Fiat, Stern/Williams.
- G. Domestic Water Heaters-Gas; Rheem/Rudd, A.O. Smith, Lochinvar, Jackson, State.
- H. Shower Enclosures - Kohler, American Standard, Crane/Fiat.
- I. Flush Valves - Sloan Royal
- J. Insulation for handicapped lavatory and sink connections insulations - Truebro McGuire "pro-wrap".
- K. Alternate flush valve selection where budget consideration requires a lower cost valve and competitive pricing.

## 2.05 VACUUM BREAKERS

- A. Furnish and install vacuum breakers on all fixtures, trim, or faucets arranged for the connection of hoses. Vacuum breaker shall be located on the discharge side of the valve.
- B. Vacuum breakers shall be chrome plated brass where exposed and rough brass where concealed.
- C. Install vacuum breakers on wall hydrants, hose bibbs, janitor sinks and wherever else required by code.

## 2.06 DOMESTIC WATER HEATER - ELECTRIC

- A. Size and capacity as indicated on drawing.
- B. 2 1/2-inch-thick polyurethane insulation R 20.
- C. To exceed ASHRAE 90.1B and HUD requirements.
- D. Adjustable controls conforming to U.L., and NEMA.
- E. Glass lined tank. Anode rods, ASME pressure and temperature relief valve, baked enamel finish, high temperature cutout.

- F. 10-year warranty.
- G. Plastic lined nipples, drain valve, individually factory tested.
- H. Non-simultaneous operation of dual heating elements.

#### 2.07 WATER HEATER DRAIN PAN

- A. Pan shall be galvanized steel - 24 gauge with a minimum height of 1 ½".
- B. Each pan shall have a 3/4" drain to an acceptable point.

#### 2.08 HEATER WARRANTIES

- A. Provide extended warranties of 5 years for commercial and 10 years for residential heaters.

#### 2.09 CIRCULATORS

- A. Circulating pumps shall be in-line, centrifugal, close coupled with mechanical seals, all bronze construction similar to TACO or Bell and Gossett.
- B. Pump shall be controlled by adjustable, immersion type Aquastat, Honeywell.

#### 2.10 WATER CLOSET CARRIER SELECTION.

- A. Carrier fitting configuration shall be suitable for the stack location shown on the drawings. Carriers to permit handicapped mounting of fixtures shall be utilized where required.

#### 2.11 WALL HUNG WATER CLOSET SUPPORTS/FITTINGS

- A. Smith No. 0100 series "adjustable" deep rough-in support. Where floor construction is not suitable for deep rough-in, Smith No. 0200 series shallow rough-in type may be used. Where furred wall space is not sufficient for the adjustable series, Smith "compact" No. 0400 series may be used.

#### 2.12 WALL HUNG BLOWOUT WATER CLOSET SUPPORTS/FITTINGS

- A. Smith No. 0300 series "adjustable series fixture supports with type No. 2 closet outlet connection. Where furred wall space is not sufficient for the adjustable series, Smith "compact" No. 0400 series or Smith No. 670 thru 680 waste fitting assemble with type No.2 closet outlet connection may be used.

#### 2.13 FLOOR MOUNTED FLOOR OUTLET WATER CLOSET CONNECTION

- A. Smith No. 9230 cast bronze closet flange assembly complete with 5/16" bronze bolts, chromium plated nuts and washers and approved gasket.

#### 2.14 WALL HUNG BLOWOUT URINALS ON FLOOR MOUNTED SUPPORT

- A. Smith No. 0629, 0630, 0632, or 0633 urinal support with adjustable coupling assembly. Face plate shall be supported by extra heavy cast iron base support which shall be securely bolted to floor construction.

#### 2.15 WALL HUNG BLOWOUT AND WASH-OUT URINALS ON FLOOR MOUNTED SUPPORT

- A. Smith No. 0600 series urinal support. Uprights shall be high-strength steel with block bases securely

bolted to floor construction.

#### 2.16 ELECTRIC WATER COOLER WALL SUPPORT

- A. Smith No. 0830 floor mounted support electric water cooler support. Uprights shall be high strength steel with block bases securely bolted to floor construction.

#### 2.17 STEEL BACKING PLATE FOR PLUMBING FIXTURES

- A. Where plumbing fixtures of the arms which support them are specified to be attached to a steel plate in the wall, furnish and install a 1/4" thick by 6" wide steel plate which shall extend at least one stud beyond the first and last fixture mounting points. Fixture or supporting arms shall be securely and firmly attached to the steel plate in accordance with the manufacturer's instructions.

#### 2.18 FLAT-SLAB LAVATORIES-CONCEALED ARMS ON BACKING PLATE

- A. Lavatories shall be punched for Smith No. 0728 concealed arm fixture support with chromium plated threaded escutcheons. The arms shall be securely bolted to steel backing plate in the wall as herein before specified. They shall have positive mechanical locking device and shall be fully adjustable after installation of the finished wall.

#### 2.19 FLAT-SLAB LAVATORIES-CONCEALED ARMS ON FLOOR SUPPORT

- A. Lavatories shall be punched for Smith No. 0700-E fixture support. Fixture support shall have chromium plated threaded escutcheons and concealed arms with positive mechanical locking device. Arms shall be fully adjustable after installation of finished wall. Uprights shall be high-strength steel with block bases securely bolted to floor construction.

#### 2.20 EMERGENCY FIXTURE TEMPERING VALVE

- A. Furnish and install a single valve emergency fixture tempering valve on all emergency fixtures utilizing domestic water with a 50-50 water mix ratio.
- B. Valve shall have a dual internal bypass that provides thermal, and pressure assisted activation with triple duty check stops.
- C. Valve shall maintain cold water flow in event of failure.
- D. Valve sizing shall be in accordance with rated fixture demand at a maximum of 20 psi pressure drop.
- E. Valve conform to ANSI-Z-358-1.
- F. Valve to be manufactured by Powers Series ES or approved equal.

### PART 3 - EXECUTION

#### 3.01 INSTALLATIONS

- A. Plumbing fixtures shall be installed in a manner to afford easy access for cleaning. Where practical, all piping from fixtures shall run in the most direct route to the wall.
- B. Furnish and install all waste connections, traps, water supplies, final connections, etc., to equipment furnished under other portions of the specifications.
- C. Make final connections to all soil, waste, vent, and water piping to the fixtures.

- D. Fixtures shall be set level and in proper alignment with adjacent walls and fixtures.
- E. All wall hung fixture carriers to be securely anchored to the slab.
- F. Attach floor mounted water closets to floor with wax seal and lag screws. Do not use lead flashing to hold closet in place.
- G. Securely bolt all fixtures to the building construction and unless special hangers are indicated, provide hangers and/or carriers designed specifically for the fixtures by the fixture manufacture.
- H. Caulk all wall hung fixtures between fixture and wall with sealant specified in Section 07900. Provide sealant at all points where mop receptor meets walls and floor.
- I. Install electric water coolers with "P" trap and water shutoff valve within cabinet.
- J. Contractor shall insulate all exposed domestic water and drainage piping under all handicapped lavatories and sinks with pre-formed insulation kit with PVC jacket similar to, Lav-Guard as manufactured by Truebro. There shall be no sharp or abrasive surfaces under the handicapped lavatories.
- K. Contractor shall provide an offset tailpiece for the handicapped lavatory's drain piping to create space for wheelchair access.
- L. Emergency tempering valves shall be accessibly located above ceilings or provided with a recessed cabinet adjacent to the fixture.

### 3.02 MOUNTING HEIGHTS

- A. Mount fixtures with the following heights above finished floor, except where noted otherwise.

#### Water Closet:

Standard	15 inches to top of bowl rim
Handicapped	17 - 19 inches to top of seat

#### Urinal:

Standard	22 inches to top of bowl rim
Handicapped	17 inches to top of bowl rim

#### Lavatory:

Standard	31 inches to top of basin rim
Handicapped	34 inches to top of basin rim or 29 inches to underside of basin apron

#### Drinking Fountain:

Standard	40 inches to top of basin rim
Handicapped	36 inches to bubbler outlet

#### Water Closet Flush Valves:

Standard	11 inches minimum above bowl rim
Handicapped	Center line of flush valve shall not exceed 44" above fin. fl. Flush valve handle shall extend toward the wide side of stall.

#### Water Closet Tank Type - Trip Lever

Standard	Per manufacturer
Handicapped	Locate on tank side toward wide side of stall.

END OF SECTION

**DIVISION 23 - HVAC****SECTION 23 05 00 - STANDARD CONDITIONS FOR HVAC****PART 1 - GENERAL****1.01 REFERENCE**

- A. Requirements established within the portions of this project manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and addenda as issued are part of this specification.
- C. Mechanical, Plumbing, and HVAC drawings along with all other project drawings and specifications represent the work of this section.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

**1.02 SCOPE**

- A. Provide labor, material, equipment, and supervision necessary to install complete operating mechanical systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.
- B. It shall be the contractor's responsibility to coordinate his work and the work of his subcontractors to ensure that all the work is covered. He shall designate who is responsible for various portions of work which may overlap so that there is complete coverage of all required work. It is the position of the owner and the A/E that all work is the responsibility of the mechanical contractor within this Division of the work.
- C. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
- D. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- E. HVAC contractor's scope of work shall include but not be limited to the following:
  - 1. Air distribution system, associated ductwork, devices, equipment, and insulation.
  - 2. Condensate drainage system (air conditioner units). Condensate pumps.
  - 3. Roof penetrations for mechanical work and all associated roof work.
  - 4. Exhaust systems.
  - 5. Test Balance & Adjust.
  - 6. Automatic Temperature Control System.
  - 7. All other work identified in Division 23 and/or on the mechanical drawings except that identified as plumbing or fire protection work.
  - 8. Contractor shall not utilize new HVAC equipment for temporary heating, cooling, and dehumidification purposes. Temporary HVAC is to be provided as described under the

- architect's general conditions. Contractor is to protect all HVAC equipment during construction and cover all ductwork openings.
9. Provide third party certification of all packaged systems by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399 as well as Pamphlet #70 and National Electrical Code Article 90-7.
  10. Fire stopping of penetrations. (See Section 23 05 50)

#### 1.03 REGULATIONS, CODES, AND STANDARDS

- A. Work shall be performed in accordance with the latest adopted codes, amendments, regulations, and ordinances of the authorities having jurisdiction. Observe all safety regulations including the requirements of OSHA.
- B. Obtain and pay for all permits, connection charges, inspections, and certificates required to complete the work.
- C. Latest editions of any referenced standards shall govern.
- D. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- E. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

#### 1.04 SUBMISSIONS

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the A/E. Submissions will be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
- D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
- E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
- F. Contractor to forward a copy of submittals which have electrical requirements to the Electrical Contractor (EC) for coordination of voltage, amperage, and phase. Response to be received from EC prior to ordering of equipment by mechanical contractor.
- G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, drains shall be combined in a single brochure with all items being furnished clearly identified.
- H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and coordinated with all other trades.
- I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified so as to be clear on what is being provided.
- J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be



fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

#### 1.05 SITE INSPECTION

- A. Visit site, inspect, and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of bid will be deemed evidence of having complied with this request. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.

#### 1.06 SUBSTITUTIONS

- A. Material and equipment specified shall be deemed as that which the bidder's quotation represents.
- B. Once bids are accepted only that material and equipment listed in the specifications or added by addenda shall be acceptable. Substitution information for inclusion in an addenda must be received by the A/E at least 10 days prior to bid opening. If acceptable, an addenda will be issued which will add the additional acceptable manufacturers or materials and be available for all contractors to consider. It shall be a basic premise that a contractor is a lowest bidder because he utilized substituted materials or equipment as opposed to specified materials or equipment.
- C. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service by the engineer at the rate of \$150.00/hr. for such services. Also billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval or rejection.
- D. If the contractor elects to submit alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the drawings and specifications, it is the contractor's responsibility to coordinate the work with other trades and pay for any associated costs with the substitution or change.
- E. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

#### 1.07 DRAWINGS AND SPECIFICATIONS

- A. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.
- B. When a conflict or contradiction exists either between drawings and specs or between specs or between different drawings or details, the more stringent shall apply.
- C. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- D. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.

- E. The architects or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.
- F. If a question arises after bidding the A/E interpretation shall govern.

#### 1.08 MEASUREMENTS

- A. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

#### 1.09 PROGRESS SCHEDULE

- A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

#### 1.10 COST SCHEDULE

- A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.
- B. AIA forms are required for this submission.

#### 1.11 COMPLETION

- A. The contractor shall deliver to the owner, with his request for final payment, copies of all manufacturer's guarantees, equipment instructional manuals, a complete set of all final shop drawings, catalog cuts, service contracts, and other items as may be required elsewhere in the documents.

#### 1.12 OFFICE

- A. The contractor shall set up his job office (desk) where directed by the owner.

#### 1.13 STORAGE

- A. Material shall be stored only where directed by the owner.

#### 1.14 SANITARY

- A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
- B. Toilet will be located where directed by the owner.

### **PART 2 - PRODUCTS**

#### 2.01 GENERAL

- A. All material shall be new and of present-day manufacturer.
- B. All material and equipment shall be in conformance with accepted trade standards.
- C. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed

to apply to as many such items as may be necessary to complete the installation.

- D. The word "provide" means "furnish and install complete, tested, and adjusted as necessary with all accessories, covers, escutcheons". The word "piping" means pipe, fitting, controls, valves, and hangers as required for a complete system.

## 2.02 MOTORS

- A. Incorporate latest IEEE and NEMA standards.
- B. All copper windings with ball bearings.
- C. Indoors; drip proof, 40 degree C rise.
- D. Outdoors; totally enclosed 55 degree C rise.
- E. Motors over 10 HP to be high efficiency with PF in excess of 0.9.

## 2.03 MOTOR STARTERS AND CONTACTORS

- A. Fractional with horsepower up to ½ HP; electrical contract.
- B. Polyphase and single phase above ½ HP: this contract.
- C. Electrical contractor shall install all starters except for those provided as an integral part of equipment.
- D. Polyphase starters shall be magnetic combination type, across-the-line electrically operated, electrically held, three pole assemblies, with arc extinguishing characteristics, silver to silver renewable contacts, 3 pole thermal bi-metallic, red run pilot light, individual phase protection, with overload heaters matched to motors installed and with 4 auxiliary contact, Hand-off-Auto switch, and control transformer.
- E. For single phase motors above ½ HP provide magnetic combination single phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120-volt control transformer with dual primary fusing auxiliary contacts.
- F. Starters shall be as manufactured by G. E., Siemens, Square "D", Cetus or Cutler-Hammer.

## 2.04 EQUIPMENT START UP

- A. Verify that equipment is operating within warranty requirements.
- B. Advise owner and A/E at least two days prior.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to A/E.

## 2.05 LUBRICATION

- A. Lubricate all equipment in accordance with manufacturer's instructions.
- B. Lubricate prior to start up.
- C. Provide one year's supply of lubricants to the owner.

## 2.06 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner's personnel in the operation and maintenance of all systems and equipment.
- B. Ensure that the owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each System as a whole.
- D. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, control sequences, service requirements, piping diagrams, names, and addresses of vendors, suppliers, and emergency contacts. Three manuals shall be provided.

- E. Provide to the owner any special tools necessary to operate any of the equipment.

#### 2.07 DRAIN PANS

- A. Provide auxiliary galvanized steel condensate drain pan with 1" MPT drain connection for all interior fan coil units, cooling coils, heat pumps, and any other cooling equipment requiring condensate removal. Drain to suitable discharge point acceptable to owner and A/E. Drain lines shall be separate and independent of A/C unit drain system unless provided with interlocked water sensing switch.
- B. Drains shall slope down in direction of flow at 1" per 10 feet.

### PART 3 - EXECUTION

#### 3.01 PROTECTION

- A. Cover duct openings during construction.
- B. Plug or cap open ends of piping systems and conduit.
- C. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
- D. Protect all installed work until accepted in place by the owner. Cover plumbing fixtures and lighting fixtures.
- E. Do not install plates, polished metal escutcheons, thermostats, and other finished devices until masonry, tile, and painting operations are complete or protect otherwise.
- F. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulating, and covering.

#### 3.02 WORKMANSHIP

- A. Install all work neat, trim, and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

#### 3.03 EXCAVATION, SHORING, PUMPING, BACKFILLING

- A. Perform all excavation required to install the work. Deposit excavated material so as not to create a slide hazard.
- B. No work shall be placed on rock. Cushion with 6 " layer of crushed stone.
- C. Protect tree roots with burlap covering and maintain moist until backfilled.
- D. Base estimates on excavation which will include earth, sand, clay, rubbish, debris, and all other materials up to one cubic yard in size. Boulders or rock larger than one cubic yard which need to be broken up with pneumatic equipment or explosives will be separately negotiated at the time of discovery with the owner and A/E. Do not proceed with rock excavation until an agreement is reached.
- E. Maintain excavations free of water.
- F. Shore excavations to prevent cave-in in accordance with OSHA regulations and to prevent strains on work put in place until ready to receive backfill.
- G. Backfill with clean material and pneumatically tamp in 8" layers. Remove excess material, including rock, from site or as directed by the A/E.
- H. Backfill piping trenches within 18" of footings, columns, piers, or grade beams, with concrete. Protect

piping from direct contact and adherence to concrete.

- I. Return to original condition any areas disturbed for excavation.

### 3.04 FASTENERS, HANGERS, AND SUPPORTS

- A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.
- B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets, and anchors to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded to more than 1/4 rated capacity with a minimum of 200 lbs.
- E. Powder driven fasteners shall not be allowed for piping larger than 2", or for equipment. When used they shall not be loaded more than 1/8 rated capacity with a minimum of 200 lbs.
- F. All hangers, miscellaneous steel, braces, and supports shall be galvanized, cadmium plated, or painted with corrosion resistant primer and finish coat of epoxy enamel.
- G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles as indicated in the piping system specification sections. Piping shall not support other piping.
- H. Support vertical piping and ductwork at floor levels. Piping shall have split rings. Ductwork shall have 1 1/2" angle iron frames.
- I. Provide and install lintels where required for mechanical work and not indicated on architectural or structural drawings.
- J. Furnish steel framing for roof openings and floor openings. Submit details for review.

### 3.05 SLEEVES

- A. All piping passing through floors or walls shall have sleeves unless holes are cored. Sleeves shall be 16 gage galvanized steel in non-bearing walls, 10 gage galvanized steel for bearing walls, and schedule 40 galvanized pipe in floors. Sleeves shall accommodate insulation. This shall not apply to sprinkler piping.
- B. Sleeves passing through foundation walls not exposed to interior spaces or sleeves passing through slab on grade may be schedule 40 PVC.
- C. Wall sleeves shall finish flush with wall.
- D. Floor sleeves shall extend 1 inch above floor.
- E. Sleeves in walls between interior spaces and unexcavated, exterior, crawl, or backfilled spaces shall be made watertight with "Link-Seal" modular wall and casing seal. Casing shall be schedule 40 galvanized pipe with anchor flange.

### 3.06 PLATES

- A. Furnish and install chrome plated plates wherever piping passes into finished areas.
- B. Plates shall be securely fastened to piping or building construction.
- C. Floor plates shall cover one inch floor extension.

### 3.07 OFFSETS, TRANSITIONS, MODIFICATIONS

- A. Furnish and install all offsets necessary to install the work and to provide clearance for the other trades.
- B. Maintain adequate headroom and clearance as directed by the A/E.
- C. Ductwork transitions necessary to accommodate available space or clearance requirements shall be contract requirements.
- D. Incidental modifications necessary to the installation of the systems shall be made as necessary and at the direction of the A/E.
- E. Rises and drops of piping systems shall be provided as required and where directed to allow for

clearances to other construction. Drains shall be installed at no additional cost to the owner. The contractor shall allow for such occurrences in his bid.

- F. Ductwork, piping, conduit, and equipment shall be so arranged as to not pass in front of windows, doors, access panels, access doors, coil removal or filter removal space or service clearance areas. Do not install within 3'-0" clearance of electrical panel fronts.

### 3.08 RECESSES

- A. Furnish information to the general contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment or devices which are to be recessed into walls.
- B. Make offsets or modifications as required to suit final locations.

### 3.09 EQUIPMENT SETTING

- A. Furnish and install as a minimum, a 4" thick concrete pad beneath all floor mounted equipment in mechanical rooms, boiler rooms, or equipment rooms, or outside on grade. This shall not apply to residential installations of water heaters and air handling units or furnaces unless detailed on drawings or specified elsewhere.
- B. Furnish and install as a minimum, spring vibration isolators under any equipment 5 HP and over and rubber-in-shear vibration isolation under all equipment less than 5 HP. This shall apply to residential installations.
- C. Reinforce concrete with No. 4 rods 12" on centers both ways.
- D. Pad to have 3/4" dowels into concrete at 1 per 4 square feet.

### 3.10 LABELING

- A. All equipment, panels, controls, safety switches, and devices shall be provided with permanent black laminated white core labels with 3/8" letters.
- B. This shall also apply to all controllers, remote start/stop push buttons, equipment cabinets, and where directed by the A/E.
- C. This shall not apply to local room thermostats and light switches.

### 3.11 FLASHING AND COUNTERFLASHING

- A. Piping and conduit through the roof shall be flashed by the General Contractor. This contractor shall furnish counterflashing.
- B. Ductwork through the roof and roof mounted duct connected equipment shall be provided with prefabricated roof curbs. General contractor shall flash. This contractor shall counterflash.
- C. Structural dunnage for roof mounted equipment shall be flashed and counterflashed. Prefabricated roof curbs may be utilized.

### 3.12 ACCESS

- A. Locate all equipment, valves, devices, and controllers which may need service in accessible places.
- B. Where access is not available; access panels shall be provided. Furnish prime painted steel access doors to the General Contractor for installation.
- C. Access doors shall be 16-gauge frames and 22 gauge steel door. Access doors in fire rated walls shall have a "B" label for 1 ½ hours.
- D. Maintain clearances for tube removal, coil pulls, and filter removal.

### 3.13 WIRING

- A. Power wiring shall be provided by the Division 26 Electrical Contractor. This contractor shall furnish all 3 phase starters, pushbuttons, and controllers necessary to operate the equipment. The Electrical Contractor shall store and install the electrical devices and furnish and install the power wiring.
- B. Control wiring shall be furnished and installed under Division 23 portion of the work. Wiring for controls is control wiring whether it is line voltage or low voltage.
- C. All wiring shall be in accordance with the NEC.
- D. Pushbuttons shall be maintain-contact type.
- E. Refer to the electrical specifications for wiring methods.
- F. Plenum rated cable is required for control wiring.

#### 3.14 UTILITIES

- A. Do not interrupt any utility or service without adequate previous notice and scheduling with the owner.
- B. Refer to Division 1 for requirements for providing temporary utilities.

#### 3.15 CUTTING AND PATCHING EXTERIOR SERVICES

- A. This contractor shall be responsible for returning disturbed areas to original condition where excavation for utilities has been required.
- B. Cut and patch paved areas to match original surfaces.
- C. Properly tamp backfill before finishing surfaces.
- D. Concrete pavements and curbs shall be formed and poured to match adjacent areas.
- E. Grass areas shall be sodded and maintained until established growth is achieved.

#### 3.16 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the owner unless otherwise specified. Material and labor for first year warranty is to be provided.
- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.
- C. Compressors and refrigeration system components shall be provided with a 5-year factory warranty. Material only for years 2 through 5 is required.

#### 3.17 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver material and equipment in manufacturer's original cartons or on skids.
- B. Store material in dry enclosures or under protective coverings out of way of work progress.
- C. Handle so as to prevent damage to product or any surrounding material.

#### 3.18 MANUFACTURERS' NAMES

- A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any deviations from this must be acknowledged at bid time by the supplier and he shall be solely responsible for any and all costs associated with the application of his product in the project.
- B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's

equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

### 3.19 AS-BUILT DRAWINGS

**Specifier: Verify if As-Built drawings need to be on CAD in addition to drawings.**

- A. At the completion of the work the contractor shall furnish a reproducible as-built drawings in digital format to the A/E for approval. The contractor is to coordinate file type. The drawings shall indicate all work installed and its actual size and location. If acceptable, the A/E will submit the as-built drawings to the owner as record drawings. If not acceptable, the A/E will return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.

### 3.20 PENETRATION SEALING

- A. All penetrations of fire walls, smoke walls, and floors by ducts, pipes, conduit, or wiring shall be sealed to prevent the flow of gasses or smoke.
- B. The sealant shall be foamed in place between the penetrant and the adjacent floor or wall with DOW Corning RTV foam or equivalent by 3M, Hilti, or Chase foam.
- C. The installation shall meet the approval of the authority having jurisdiction.
- D. Penetrations through rated surfaces shall have a UL rating equivalent to the adjacent surfaces.
- E. All other penetrations of walls either above ceilings or exposed shall be closely sealed around the penetration with caulking or packing to prevent flow of air or sound through the wall.

### 3.21 CUTTING AND PATCHING INTERIOR SURFACES

- A. Respective contractor shall install all hangers, supports, pipe sleeves in floors, walls, partitions, ceilings, and roof slabs as construction progresses to permit their work to be built into place and to eliminate unnecessary cutting of construction work.
- B. All cutting of concrete, or other material for the passage of piping and ductwork through floors, walls, partitions, and ceiling shall be done by the respective contractor where necessary to install his work. Respective contractor will close all such openings around piping, ductwork, and conduit with materials equivalent to that removed. All exposed surfaces shall be left in suitable condition for refinishing without further work.
- C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

### 3.22 INVERTS AND ELEVATIONS

- A. Indicated inverts and elevations of existing utilities are approximate and based on the best information available.
- B. Upon award of contract, contractor shall verify in the field all such information and report any discrepancies before proceeding with work. Contractor shall be responsible for extra work caused by his failure to verify inverts and elevations.

### 3.23 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

- A. Furnish and install final connections to equipment furnished in other parts of the specification or furnished by the owner. Provide drainage connections, vent connections, water connections, fuel gas connections, duct connections, gas connections to the fixtures or equipment. Plumbing



connections shall include valved supplies and trapped waste connections.

### 3.24 COORDINATION DRAWINGS

- A. Provide 3/8" = 1'-0" scale drawings showing all coordinated ductwork, piping, conduit, and equipment of all trades.
- B. The sheet metal shop drawings may be used as the basis of these drawings.
- C. Show ductwork, walls, beams, steel, drainage piping, domestic water piping, HVAC piping, sprinkler piping, light fixtures, electrical conduit, and equipment.
- D. Contact other disciplines and obtain information to identify fully coordinated systems.
- E. Submit for review and approval to the A/E.
- F. Provide all dimensional data and necessary clearances to other trades for installation of fixtures and equipment within casework and counter tops.
- G. Work shall not proceed until coordination is completed and all conflicts, issues, sequences etc., are resolved.

### 3.25 WELDING

- A. All electric power for arc welding shall be supplied by the contractor performing the work.

### 3.26 VEHICLES

- A. Vehicle access to the site will be as directed by the owner.

### 3.27 RUBBISH DISPOSAL

- A. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

### 3.28 PROTECTION

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.

### 3.29 SCAFFOLDING

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

### 3.30 CLEANUP

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Clean and polish all plumbing fixtures.
- D. Remove all trash and debris from the premises.

### 3.31 MOUNTING HEIGHTS

- A. Contractor to coordinate all mounting heights with all trades and architect prior to rough-in.
- B. Maximum thermostat mounting height (top of thermostat) in accordance with ADA.
  - 1. Side reach: 48" A.F.F.
  - 2. Forward reach: 48" A.F.F.

### 3.32 WORK COMPLETION

- A. The contractor shall promptly correct work rejected by the engineer failing to conform to the requirements of the contract documents, whether discovered before or after substantial completion and whether or not fabricated, installed or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

### 3.33 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

- A. All RFI's shall include the following information based on AIA Document G716:
  - 1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
  - 2. Provide a description with specification and/or drawing references.
  - 3. Provide the senders recommendation including cost and/or schedule considerations.
  - 4. Provide receiver's reply space.
  - 5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

### 3.34 SHOP DRAWING REQUIREMENTS

- A. The following is a list of required shop drawings for the project. Not all items may be identified, and it is the responsibility of the contractor to submit additional shop drawings where indicated in the specifications.

HVAC	DATE REC'D	ACTION	DATE REC'D	ACTION
COORDINATION DRAWINGS				
VIBRATION ISOLATION				
INSULATION A. Piping B. Ductwork C. Equipment				
SHEET METAL DRAWINGS				
HEATERS				
FANS				
HEAT PUMPS/ VRF SYSTEM / REF. PIPING				
ROOFTOP UNITS				
SPLIT SYSTEMS				

<b>HVAC</b>	<b>DATE REC'D</b>	<b>ACTION</b>	<b>DATE REC'D</b>	<b>ACTION</b>
PACKAGED UNITS				
FIRE DAMPERS				
VOLUME DAMPERS				
SMOKE DAMPERS				
GRILLES, REGISTERS, DIFFUSERS				
LOUVERS/ROOF CAPS				
EQUIPMENT CURBS				
AUTOMATIC TEMPERATURE CONTROL A. DEVICES B. WIRING DIAGRAMS C. SEQUENCES				
TEST, BALANCE AND ADJUST REPORT				
AS-BUILT DRAWINGS				
WARRANTIES AND GUARANTEES				
OPERATIONS AND MAINTENANCE MANUALS				
INSTRUCTIONS				
EMERGENCY AND MANUFACTURER CONTACTS				

END OF SECTION

**SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small, and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

**1.02 COORDINATION**

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

**1.03 SUBMITTALS**

- A. Shop drawing submittals for motorized equipment shall include, but not limited to, the following information on motors provided with equipment.
  - 1. Manufacturer's name and cutsheets.
  - 2. Motor type.
  - 3. Horsepower.
  - 4. Voltage/Phase/Hertz.
  - 5. RPM.
  - 6. Service factor.
  - 7. Insulation class.
  - 8. NEC code number.
  - 9. Motor efficiency and testing method and results.

**PART 2 - PRODUCTS****2.01 GENERAL MOTOR REQUIREMENTS**

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. All materials and equipment furnished shall be installed as per manufacturer's requirements and conform to the requirements of Division 26.

**2.02 MOTOR CHARACTERISTICS**

- A. Duty: Continuous duty at ambient temperature of 40 deg. C and at altitude of 3300 feet

- above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- C. Incorporate latest IEEE and NEMA standards.
- D. All copper windings with ball bearings.
- E. Indoors; drip proof, 40 degree C rise.
- F. Outdoors; totally enclosed 55 degree C rise.
- G. Motors over 10 HP to be high efficiency with PF in excess of 0.9.

## 2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

## 2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

## 2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp. shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.

- 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

## 2.06 MOTOR STARTERS

- A. Fractional with horsepower up to ½ HP; electrical contract.
- B. Polyphase and single phase above ½ HP: this contract.
- C. Electrical contractor shall install all starters except for those provided as an integral part of equipment.
- D. Polyphase starters shall be magnetic combination type, across-the-line electrically operated, electrically held, three pole assemblies, with arc extinguishing characteristics, silver to silver renewable contacts, 3 pole thermal bi-metallic, red run pilot light, individual phase protection, with overload heaters matched to motors installed and with 4 auxiliary contact, Hand-off-Auto switch, and control transformer.
- E. For single phase motors above ½ HP provide magnetic combination single phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120-volt control transformer with dual primary fusing auxiliary contacts.
- F. Starters shall be as manufactured by G. E., Siemens, Square "D", Cerus or Cutler-Hammer.

## PART 3 - EXECUTION

### 3.01 GENERAL:

- A. Motors shall be leveled, set in true angular and concentric alignment with driven equipment, and bolted firmly to motor base, if not mounted on equipment. Motors's factory-mounted on equipment shall be checked for alignment to driven equipment and mounting bolts shall be checked to ensure bolts are tightly fastened.
- B. Coordination: The Mechanical Contractor shall have the responsibility to provide adequate rough-in information to the Electrical Contractor. Any costs, such as patching and refinishing of walls, resulting from inadequate information shall be the responsibility of the Mechanical Contractor.
- C. For variable frequency drives, refer to Specification 23 09 93.

END OF SECTION

**SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Sleeves.
  2. Sleeve-seal systems.
  3. Grout.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

**2.02 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
  2. CALPICO, Inc.
  3. GPT; an EnPro Industries company.
  4. Metraflex Company (The).
  5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  2. Pressure Plates: Carbon steel.
  3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

## 2.03 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealant appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### 3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:



- a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves.
- 2. Exterior Concrete Walls below Grade:
  - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
  - a. Piping Smaller Than NPS 6-inch: Cast-iron wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6-inch: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
  - a. Piping Smaller Than NPS 6-inch: Galvanized-steel-pipe sleeves.

END OF SECTION

**SECTION 23 05 18 - ESCUTCHEONS FOR HVAC PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With [polished, chrome plated and rough brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring clip fasteners.

**2.02 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

**PART 3 - EXECUTION****3.01 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep-pattern type.
    - b. Chrome-Plated Piping: One piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece,

- cast-brass type with polished, chrome-plated finish.
- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, stamped-steel type.
- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast-brass type with polished, chrome-plated finish.
- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, stamped-steel type.
- h. Bare Piping in Unfinished Service Spaces: One piece, cast-brass type with polished, chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One piece, stamped-steel type.
- j. Bare Piping in Equipment Rooms: One piece, cast-brass type with polished, chrome-plated finish.
- k. Bare Piping in Equipment Rooms: One piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One piece, floor-plate type.

### 3.02 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

**SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Equipment supports.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment [ and obtain approval from authorities having jurisdiction].

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following: include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

**1.04 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

**1.05 QUALITY ASSURANCE**

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## **PART 2 - PRODUCTS**

### **2.01 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe Hangers:
  - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
- D. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

### **2.02 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop or field fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### **2.03 THERMAL-HANGER SHIELD INSERTS**

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

### **2.04 FASTENER SYSTEMS**

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert wedge type, stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate

for supported loads and building materials where used.

## 2.05 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.06 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

# PART 3 - EXECUTION

## 3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS

2-1/2-inch and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4-inch and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4-inch and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS ¼-inch to NPS 2 ½ -inch: 12 inches long and 0.048 inch thick.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous thread hanger and support rods to 1 ½ inches.

### 3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2-inch to NPS 30-inch.
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4-inch to NPS 36-inch, requiring clamp flexibility and up to 4 inches of insulation.
  - 3. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1-inch to NPS 30-inch, from two rods if longitudinal movement caused by expansion and contraction might occur.
  - 4. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2-inch to NPS 42-inch if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS ¾-inch to NPS 24-inch.
  - 2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS ¾-inch to NPS 24-inch if longer ends are required for riser clamps.



- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1 ¼ inches.
  2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

**SECTION 23 05 48.13 - VIBRATION CONTROLS FOR HVAC****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Elastomeric isolation mounts
  - 2. Spring hangers
  - 3. Pre-compressed spring and neoprene hangers
  - 4. Roof curb bases

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each vibration isolation device.
  - 1. Include design calculations for selecting vibration isolators.

**PART 2 - PRODUCTS****2.01 ELASTOMERIC ISOLATION PADS**

- A. Elastomeric Isolation Pads:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Kinetics Noise Control, Inc.
    - b. Mason Industries, Inc.
  - 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
  - 3. Size: Factory or field cut to match requirements of supported equipment.
  - 4. Pad Material: Oil and water resistant with elastomeric properties.
  - 5. Surface Pattern: Waffle pattern.
  - 6. Infused nonwoven cotton or synthetic fibers.
  - 7. Load-bearing metal plates adhered to pads.
  - 8. Application: Floor mounted furnaces and A/C units of 2000 CFM or less. Roof mounted condensing units up to 5 tons shall be mounted on curbs with neoprene pads. See spring mounts for over 5 tons.

**2.02 SPRING HANGERS**

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Kinetics Noise Control, Inc.
    - b. Mason Industries, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
10. Application: Below 5-ton horizontal suspended heat pumps and fan/coil units, in-line exhaust fans.

#### 2.03 PRE-COMPRESSED SPRING AND NEOPRENE HANGERS

- A. Vibration hangers shall be spring, and neoprene as described above, but they shall be pre-compressed to the rated deflection so as to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale.
- B. Hangers shall be type PC3ON as manufactured by Mason Industries, Inc. or equivalent by Vibration Eliminator Company or Amber Booth.
- C. Application: Horizontal fan/coil units above 5-ton capacity.

#### 2.04 ROOF CURB BASES

- A. Curb mounted rooftop equipment shall be mounted on vibration isolation bases that fit over the roof curb and under the isolated equipment. The extruded aluminum top members shall overlap the bottom member to provide water runoff independent of the seal. The aluminum member shall house cadmium plated springs having a 1 inch, 2-inch minimum deflection with 50% addition travel to solid. Spring diameters shall be no less than 0.8 of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4" so as not to interfere with the spring action except in high winds. The weather seal shall consist of continuous closed cell sponge materials both above and below the base and a waterproof flexible duct like connection joining the outside perimeter of the aluminum members. Foam or other contact like seals are unacceptable at the spring cavity closure. Caulking shall be kept to a minimum.
- B. Curb mounted bases shall be type CMAB as manufactured by Mason Industries or equivalent by Vibration Eliminator Company, Amber Booth, Thi-Curb, Custom Curb or R.P.S.
- C. Application: Roof mounted A/C units, air handling units and separated condensing units.

### PART 3 - EXECUTION

#### 3.01 VIBRATION CONTROL DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Architectural specification sections.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Select the appropriate base to match the equipment being provided. Base shall meet the exact dimensional and weight requirements at all points of the curb. Install as recommended by the vibration isolator manufacturer.

END OF SECTION

**SECTION 23 05 50 - FIRE STOPPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Refer to Section 23 05 00 for requirements which are applicable to this section.
- B. Refer to International Building Codes.
- C. Section includes.
  - 1. Through penetration firestops and smoke-stops for all fire rated bearing and non-bearing wall and floor assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.

**1.02 REFERENCES**

- A. American Society for Testing and Materials Standards (ASTM):
  - 1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM E814: Standard Test method for Fire Tests of Through-Penetration Firestops.
- B. Underwriters Laboratories, Inc.:
  - 1. UL 723 Surface Burning Characteristics of Building Materials
  - 2. UL 1479 Fire Tests of Through-Penetration Firestops.
- C. UL Fire Resistance Directory:
  - 1. Through Penetration Firestop Devices (XHJI)
  - 2. Fire Resistive Ratings (BXUV)
  - 3. Through Penetration Firestop Systems (XHEZ)
  - 4. Fill, Void, or Cavity Material (XHHW)

**1.03 DEFINITIONS**

- A. FIRESTOPPING: The use of a material or combination of materials in a fire rated structure (wall or floor) where it has been breached, so as to restore the integrity of the fire rating on that wall or floor.
- B. SYSTEM: The use of a specific firestop material or combination of materials in conjunction with a specific wall or floor construction type and a specific penetrant(s), constitutes a "System."
- C. BARRIER: Any bearing or non-bearing wall or floor that has an hourly fire and smoke rating.
- D. THROUGH-PENETRATION: Any penetration of a fire rated wall or floor that completely breaches the barrier.
- E. MEMBRANE-PENETRATION: Any penetration in a fire rated wall that breaches only one side of the barrier.
- F. CONSTRUCTION GAPS: any gap, joint, or opening, whether static or dynamic, where the top of a wall may meet a floor; wall to wall applications; edge to edge floor configurations; floor to exterior wall; or any linear breach in a rated barrier. Where movement is required, the firestopping system must comply with UL2079 for dynamic joints.

**1.04 SUBMITTALS**

NOTE: A "Certificate of Conformance," from the manufacturers listed in Section "2.02 Acceptable Manufacturers," is required with the "Submittal Package" to ensure that the material selected meets all of the criteria of this specification as set forth in Section "1.05 Quality Assurance."

- A. Submit manufacturer's product literature for each type of firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance and imitation criteria, and test data. Submittal should be in compliance with Section 23 05 00.
- B. Material Safety Data Sheets (MSDS): Submit MSDS for each firestop product.
- C. UL Tested Systems: Submit drawings showing typical installation details for the methods of installation. Indicate which firestop materials will be used and thickness for different hourly ratings.
- D. Engineering Judgments: Submit manufacturer's drawings for all non-standard applications where no UL tested system exists. All drawings must indicate the "Tested" UL system upon which the judgment is based so as to assess the relevance of the judgment to some known performance.
- E. Submit manufacturer's installation procedures for each type of product.
- F. Approved Applicator: Submit document from manufacturer wherein manufacturer recognizes the installer as qualified or submit a list of past projects to demonstrate capability to perform intended work.
- G. Upon completion, installer shall provide written certification that materials were installed in accordance with the manufacturer's installation instructions and details.

#### 1.05 QUALITY ASSURANCE

- A. Firestopping systems (materials and design):
  - 1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
  - 2. The F rating must be minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions.
- B. Firestopping materials and systems must be capable of closing or filling through openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).
- C. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.
- D. Firestopping sealants must be flexible, allowing for normal pipe movement.
- E. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.
- F. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.
- G. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).
- H. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestop manufacturer.
- I. Material used shall be in accordance with the manufacturer's written installation instructions.

**1.06 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver material in the manufacturer's original, unopened containers or packages with the manufacturer's name, product identification, lot number, UL label and mixing and installation instructions as applicable.
- B. Store materials in the original, unopened containers or packages and under conditions recommended by the manufacturer.
- C. All firestop materials will be installed prior to expiration of shelf life.

**1.07 PROJECT CONDITIONS**

- A. Conform to manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.
- B. Verify the condition of the substrates before starting work.
- C. Weather Conditions: Do not proceed with installation of firestop materials when temperatures fall outside the manufacturer's suggested limits.
- D. Care should be taken to ensure that firestopping materials are installed so as not to contaminate adjacent surfaces.

**1.08 SEQUENCING**

- A. Schedule firestopping after installation of penetrants but prior to concealing the openings.
- B. Firestopping shall precede gypsum board finishing.

**1.09 PROTECTION**

- A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

**PART 2 - PRODUCTS****2.01 GENERAL**

- A. Firestopping materials and systems shall meet the requirements specified herein.
- B. Architect must approve in writing any alternates to the materials and system specified herein.
- C. All firestop products and systems shall be designed and installed so that the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.
- D. For applications where combustible penetrants are involved, i.e., insulated, and plastic pipe, a suitable intumescent material must be used.

**2.02 ACCEPTABLE MANUFACTURERS**

NOTE: Inclusion of materials in this specification does not indicate that the listed products have been evaluated for conformance to this specification. Therefore, the user/contractor must certify in the submittal package, with a "Certificate of Conformance" from the manufacturers listed below, that the material selected meets all of the criteria set forth in

Section "1.05 Quality Assurance" of this specification.

- A. Specified Technologies, Inc./GE Pensil® (STI), Somerville, NJ 08876, Phone: (800) 992-1180.
- B. 3M Fire Protection Products, St. Paul, MN

## 2.03 MATERIALS

- A. Intumescent Firestop Sealants and Caulks:
  - 1. STI SpecSeal SSS100
  - 2. 3M Fire Barrier Caulk CP25WB+
- B. Latex Firestop Sealant
  - 1. STI SpecSeal LC150 Sealant
- C. Elastomeric Water-Based Sealant
  - 1. STI SpecSeal ES100 Elastomeric Sealant
- D. Silicone Firestop Sealants and Caulks:
  - 1. STI SpecSeal Pensil 300\
  - 2. 3M Fire Barrier Silicone Sealants
- E. Firestop Putty:
  - 1. STI SpecSeal Firestop Putty Bars and Pads
  - 2. 3M Fire Barrier Moldable Putty
- F. Firestop Collars:
  - 1. STI Spec Seal Firestop Collars
  - 2. 3M Fire Barrier PPD's.
- G. Wrap Strips:
  - 1. SpecSeal Wrap Strip
  - 2. 3M Fire Barrier FS195 Wrap Strip.
- H. 2-Part Silicone Firestop Foam:
  - 1. STI SpecSeal Pensil 200
  - 2. 3M Fire Barrier 2001 Silicone Foam.
- I. Firestop Mortar:
  - 1. STI SpecSeal Mortar.
- J. Firestop Pillows:
  - 1. STI SpecSeal Pillows
- K. Elastomeric Spray:
  - 1. STI SpecSeal AS Elastomeric Spray
- L. Composite Board:
  - 1. 3M Barrier Sheet Material
- M. Accessories:

- 2.04 Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer recommendation.

## PART 3 - CONDITIONS REQUIRING FIRESTOPPING

- 3.01 General:



- A. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.
- B. Through-Penetrations:
  - 1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.
- C. Membrane-Penetrations:
  - 1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.
- D. Construction Joints/Gaps:
  - 1. Fire Stopping shall be provided:
    - a. Between the edges of floor slabs and exterior walls.
    - b. Between the tops of walls and the underside of floors
    - c. In the control joint in masonry walls and floors
    - d. In expansion joints.
- E. Smoke-Stopping:
  - 1. As required by the other Sections, Smoke-Stops shall be provided for Through-Penetrations, Membrane-) Penetrations, and Construction Gaps with a material approved and tested for such application.

### 3.02 EXAMINATION

- A. Examine the areas and conditions where firestops are to be installed and notify the architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the architect and in accordance with Section 01039.
- B. Verify that environmental conditions are safe and suitable for installation of firestop products.
- C. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

### 3.03 INSTALLATION

- A. General:
  - 1. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
  - 2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
  - 3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
  - 4. Seal holes and penetrations to ensure an effective smoke seal.
  - 5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
  - 6. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
  - 7. All combustible penetrants (e.g., Non-metallic pipes or insulated metallic pipes) shall be fire stopped using products and systems tested in a configuration representative of the field condition.
- B. Dam Construction: When required to properly contain firestopping materials within openings damming or packing materials may be utilized. Combustible damming material

must be removed after appropriate curing. Non-combustible damming materials may be left as a permanent component of the firestop system.

#### 3.04 FIELD QUALITY CONTROL

- A. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
- B. Follow safety procedures recommended in the Material Safety Data Sheets.
- C. Finish surfaces of firestopping which are to remain exposed in the completed work to a uniform and level condition.
- D. All areas of work must be accessible until inspection by the applicable Code Authorities.
- E. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification.

#### 3.05 CLEANING

- A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
- B. Leave finished work in neat, clean condition with no evidence of spill overs or damage to adjacent surfaces.

END OF SECTION

**SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.
  4. Duct labels.

**1.02 ACTION SUBMITTALS**

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

**PART 2 - PRODUCTS****2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Brimar Industries, Inc.
    - c. Carlton Industries, LP.
    - d. Champion America.
    - e. Craftmark Pipe Markers.
    - f. emedco.
    - g. Kolbi Pipe Marker Co.
    - h. LEM Products Inc.
    - i. Marking Services, Inc.
    - j. Seton Identification Products.
  2. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  3. Letter Color: Black.
  4. Background Color: White.
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by ¾ inch.
  6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  7. Fasteners: Stainless-steel self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with

- substrate.
- B. Plastic Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Brimar Industries, Inc.
    - c. Carlton Industries, LP.
    - d. Champion America.
    - e. Craftmark Pipe Markers.
    - f. emedco.
    - g. Kolbi Pipe Marker Co.
    - h. LEM Products Inc.
    - i. Marking Services, Inc.
    - j. Seton Identification Products.
  2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
  3. Letter Color: Black.
  4. Background Color: White.
  5. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
  6. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
  7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  8. Fasteners: Stainless-steel self-tapping screws.
  9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8 ½ by 11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.02 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
  2. Brimar Industries, Inc.
  3. Carlton Industries, LP.
  4. Champion America.
  5. Craftmark Pipe Markers.
  6. emedco.
  7. LEM Products Inc.
  8. Marking Services Inc.
  9. National Marker Company.
  10. Seton Identification Products.

- 11. Stranco, Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: White
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by ¾ inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

## 2.03 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
  - 2. Brady Corporation.
  - 3. Brimar Industries, Inc.
  - 4. Carlton Industries, LP.
  - 5. Champion America.
  - 6. Craftmark Pipe Markers.
  - 7. emedco.
  - 8. Kolbi Pipe Marker Co.
  - 9. LEM Products Inc.
  - 10. Marking Services Inc.
  - 11. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: Size letters according to ASME A13.1 for piping. At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

## 2.04 DUCT LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.

2. Brimar Industries, Inc.
  3. Carlton Industries, LP.
  4. Champion America.
  5. Craftmark Pipe Markers.
  6. emedco.
  7. Kolbi Pipe Marker Co.
  8. LEM Products Inc.
  9. Marking Services Inc.
  10. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- C. Letter Color: Black.
- D. Background Color: White.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg. F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2 ½ by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### **3.02 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

#### **3.03 PIPE LABEL INSTALLATION**

- A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet areas of congested piping and equipment.
- C. Pipe Label Color Schedule:
1. Chilled-Water Piping: White letters on a safety-green background.
  2. Condenser-Water Piping: White letters on a safety-green background.
  3. Heating Water Piping: White letters on a safety-green background.
  4. Refrigerant Piping: Black letters on a safety-orange background.
  5. Low-Pressure Steam Piping: White letters on a safety-purple background.
  6. High-Pressure Steam Piping: White letters on a safety-purple background.
  7. Steam Condensate Piping: White letters on a safety-purple background.
- 3.04 DUCT LABEL INSTALLATION
- A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
1. Blue: For cold-air supply ducts.
  2. Yellow: For hot-air supply ducts.
  3. Green: For exhaust, outside, relief, return, and mixed-air ducts.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

**SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.

**1.02 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

**1.03 ACTION SUBMITTALS**

- A. LEED Submittals:
  - 1. Air-Balance Report for Prerequisite IEQ 1: Documentation indicating that work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
  - 2. TAB Report for Prerequisite EA 2: Documentation indicating that work complies with ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

**1.04 INFORMATIONAL SUBMITTALS**

- A. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

**1.05 QUALITY ASSURANCE**

- A. TAB Specialists Qualifications: Certified by AABC or NEBB.
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
  - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."



**PART 2 - EXECUTION****2.01 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

**2.02 PREPARATION**

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system

readiness for TAB work. Include, at a minimum, the following:

1. Airside:
  - a. Duct systems are complete with terminals installed.
  - b. Volume, smoke, and fire dampers are open and functional.
  - c. Clean filters are installed.
  - d. Fans are operating, free of vibration, and rotating in correct direction.
  - e. Automatic temperature-control systems are operational.
  - f. Ceilings are installed.
  - g. Windows and doors are installed.
  - h. Suitable access to balancing devices and equipment is provided.

## 2.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
  3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

## 2.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."
- L. The contractor shall allow for (2) passes for each heating and cooling season.
- M. Allow for one sheave change for 50% of the HVAC systems to be tested and adjusted.

Replacement sheave shall be furnished and installed by the mechanical contractor. Sheave shall be adjusted by the TBA contractor.

## 2.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.
    - b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air-handling system.
    - d. Report artificial loading of filters at the time static pressures are measured.
  - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 4. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
  - 1. Measure airflow of submain and branch ducts.
  - 2. Adjust submain and branch duct volume dampers for specified airflow.
  - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
  - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  - 2. Measure inlets and outlets airflow.
  - 3. Adjust each inlet and outlet for specified airflow.
  - 4. Re-measure each inlet and outlet after they have been adjusted.

## 2.06 DUCTWORK LEAKAGE TESTING

- A. Installed ductwork shall be tested prior to installation of access doors, take-offs, etc.
- B. All leak testing shall be witnessed by the engineer or representative of the engineer. The

contractor shall give the engineer 72 hours' notice prior to testing. Any testing not witnessed by the engineer or his/her representative shall be considered invalid and will be redone.

C. The testing shall be performed as follows:

1. Perform testing in accordance with HVAC Air Duct Leakage Test Manual.
2. Use a certified orifice tube for measuring the leakage.
3. Determine section of system to be tested and blank off.
4. Determine the percentage of the system being tested.
5. Using that percentage, determine the allowable leakage (cfm) for that section being tested.
6. Pressurize to operating pressure and repair any significant or audible leaks.
7. Repressurize the measure leakage.
8. Repeat steps 6 and 7 until the leakage measured is less than the allowable defined in step 5.

NOTE: It is recommended that the first 100' of ductwork installed be tested to ensure the quality of the workmanship at an early stage.

## 2.07 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

## 2.08 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
  3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
  2. Fan curves.
  3. Manufacturers' test data.
  4. Field test reports prepared by system and equipment installers.
  5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB specialist.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
  3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Filter static-pressure differential in inches wg.
  - f. Preheat-coil static-pressure differential in inches wg.
  - g. Cooling-coil static-pressure differential in inches wg.
  - h. Heating-coil static-pressure differential in inches wg.
  - i. Outdoor airflow in cfm.
  - j. Return airflow in cfm.
  - k. Outdoor-air damper position.
  - l. Return-air damper position.
  - m. Vortex damper position.
- F. Air-Terminal-Device Reports:
- 1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft.
  - 2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Air velocity in fpm.
    - c. Preliminary airflow rate as needed in cfm.
    - d. Preliminary velocity as needed in fpm.
    - e. Final airflow rate in cfm.
    - f. Final velocity in fpm.
    - g. Space temperature in deg. F.
- G. Instrument Calibration Reports:
- 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.
- 2.09 VERIFICATION OF TAB REPORT
- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.
  - B. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
  - C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
  - D. If the number of "FAILED" measurements is greater than 10 percent of the total

measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

2.10 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

**SECTION 23 07 13 - DUCT INSULATION****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed return located in unconditioned space.
  - 4. Indoor, exposed return located in unconditioned space.
  - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
  - 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Related Sections:
  - 1. Section 230716 "HVAC Equipment Insulation."
  - 2. Section 230719 "HVAC Piping Insulation."
  - 3. Section 233113 "Metal Ducts" for duct liners.
- C. Insulation to be in accordance with ASHRAE 90.1-2016.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
  - 1. For each type of insulation product indicated, include thermal conductivity, water-vapor permeability for closed cell insulations, thickness, applicable ASTM standard specification, and jackets (both factory- and field-applied, if any). For each type of vapor retarder or jacket specified, include water vapor permeability, required thickness, and applicable ASTM standard specification.
  - 2. Product Data: For adhesives, indicating VOC content.
  - 3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
  - 4. Product Data: For coatings, indicating VOC content.
  - 5. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
  - 6. Product Data: For sealants, indicating VOC content.
  - 7. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, dampers, specialties, and flanges for each type of insulation.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.

**1.03 INFORMATIONAL SUBMITTALS**



- A. Field quality-control reports.

#### 1.04 QUALITY ASSURANCE

- A. Install insulation in accordance with the manufacturer's instructions.

Material Certifications: Manufacturers can provide information regarding material and testing certifications from a qualified testing agency acceptable to authorities having jurisdiction (AHJ). The AHJ can use this information for indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. (Many companies published compliance data on public data sheets while also offering technical resources for additional information. The wording was adjusted to reflect this.)

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency. Suggestion: or proper documentation indicating compliance. (Some fabricated materials used by the industry do not come directly from the manufacturer, so this documentation can be provided in those cases).
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

## PART 2 - PRODUCTS

### 2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Products that come in contact with austenitic stainless-steel operating at temperatures between 140°F and 250°F shall have a leachable chloride content in accordance with the limits set by ASTM C795 (Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel).
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795. See above.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, [Type I] Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. CertainTeed Corporation.
  - b. Johns Manville; a Berkshire Hathaway company.
  - c. Knauf Insulation.
  - d. Manson Insulation Inc.
  - e. Owens Corning.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA, or Type IB. For duct and plenum applications, provide insulation with factory applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Knauf Insulation.
    - d. Manson Insulation Inc.
    - e. Owens Corning.

## 2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  - 2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  - 2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Dow Corning Corporation.
  - b. Johns Manville; a Berkshire Hathaway company.
  - c. P.I.C. Plastics, Inc.
  - d. Speedline Corporation.
2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.03 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  1. VOC Content: 420 g/L or less.
  2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Foster Brand; H. B. Fuller Construction Products.
    - b. Knauf Insulation.
    - c. Vimasco Corporation.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg. F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.

## 2.04 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250° F.
  5. Color: Aluminum.
  6. Sealant shall have a VOC content of 420 g/L or less.
  7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Childers Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250° F.
5. Color: White.
6. Sealant shall have a VOC content of 420 g/L or less.
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.05 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
- B. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.06 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Childers Brand; H. B. Fuller Construction Products.

## 2.07 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
    - e. Venture Tape.
  2. Width: 3 inches
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces' force/inch in width.
  5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
    - e. Venture Tape.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces' force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
    - e. Venture Tape.
  2. Width: 2 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces' force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.

## 2.08 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ITW Insulation Systems; Illinois Tool Works, Inc.
    - b. RPR Products, Inc.
- B. Insulation Pins and Hangers:
  1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) AGM Industries, Inc.
      - 2) Gemco.
      - 3) Hardcast, Inc.
      - 4) Midwest Fasteners, Inc.
      - 5) Nelson Stud Welding.

- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Aluminum, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Gemco.
    - 2) Midwest Fasteners, Inc.
  - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1 ½ inches in diameter.
  - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2 ½ inches.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) Gemco.
    - 3) Hardcast, Inc.
    - 4) Midwest Fasteners, Inc.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Aluminum, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1 ½ inches in diameter.
- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) AGM Industries, Inc.
    - 2) Gemco.
    - 3) Hardcast, Inc.
    - 4) Midwest Fasteners, Inc.
    - 5) Nelson Stud Welding.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
  - c. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1 ½ inches in diameter.

- d. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Gemco.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, galvanized steel.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. C & F Wire.

## 2.09 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

## PART 3 - EXECUTION

### 3.01 PREPARATION

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

### 3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during storage, application, and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation

- material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
  - K. Install insulation with factory-applied jackets as follows:
    - 1. Draw jacket tight and smooth.
    - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
    - 3. Overlap jacket longitudinal seams at least 1 ½ inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      - a. For below ambient services, apply vapor-barrier mastic over staples.
    - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
    - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
  - L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
  - M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
  - N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.03 PENETRATIONS

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



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

### 3.04 INSTALLATION OF MINERAL-FIBER INSULATION

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

- individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive tape, or and insulation pins. Follow manufacturer's installation instructions.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over compress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory or field applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50°F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.05 FINISHES

- A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
  - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.
- D. Local building code and fire marshal shall approve before painting.

### 3.06 FIELD QUALITY CONTROL

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

### 3.07 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply, return and outdoor air.
  2. Indoor, exposed supply and outdoor air.
  3. Indoor, concealed return located in unconditioned space.
  4. Indoor, exposed return located in unconditioned space.
  5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
  6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:
  1. Fibrous-glass ducts.
  2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  3. Factory-insulated flexible ducts.
  4. Factory-insulated plenums and casings.
  5. Flexible connectors.
  6. Vibration-control devices.
  7. Factory-insulated access panels and doors.

### 3.08 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft. nominal density. "R" value of 4.2.
- B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft nominal density. "R" value of 4.2.
- C. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft nominal density. "R" value of 4.2.
- D. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 0.75-lb/cu. Ft. nominal density. "R" value of 4.2.

- E. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. "R" value of 4.2.
- F. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. "R" value of 4.2.
- G. Exposed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. "R" value of 4.2.
- H. Exposed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 3-lb/cu. ft. nominal density. "R" value of 4.2.

### 3.09 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
  - 1. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board 3 inches thick and 6-lb/cu. ft. nominal density. "R" value of 8.3.
  - 2. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb./cu. ft. nominal density. "R" value of 8.3.
  - 3. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density. "R" value of 8.3.
  - 4. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density. "R" value of 8.3.
  - 5. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density. "R" value of 8.3.
  - 6. Concealed, locker room / shower exhaust Insulation: Mineral-fiber board, 3 inches thick and 6-lb/cu. ft. nominal density. "R" value of 8.3.

END OF SECTION

**SECTION 23 07 19 - HVAC PIPING INSULATION****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes insulating the following HVAC piping systems:
  - 1. Refrigerant suction and hot-gas piping.
- B. Related Sections:
  - 1. Section 230713 "Duct Insulation."

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of insulation product indicated, include thermal conductivity, water-vapor permeability for closed cell insulations, thickness, applicable ASTM standard specification, and jackets (both factory- and field-applied, if any). For each type of vapor retarder or jacket specified, include water vapor permeability, required thickness, and applicable ASTM standard specification.
- B. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
  - 3. Product Data: For coatings, indicating VOC content.
  - 4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
  - 5. Product Data: For sealants, indicating VOC content.
  - 6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at pipe expansion joints for each type of insulation.
  - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 4. Detail removable insulation at piping specialties.
  - 5. Detail application of field-applied jackets.
  - 6. Detail application at linkages of control devices.

**1.03 INFORMATIONAL SUBMITTALS (Only as necessary)**

- A. Field quality-control reports.

**1.04 QUALITY ASSURANCE**

- A. Material Certifications: Manufacturers can provide information regarding material and testing certifications from a qualified testing agency acceptable to authorities having jurisdiction (AHJ). The AHJ can use this information for indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with

- requirements indicated.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## PART 2 - PRODUCTS

### 2.01 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Products that come in contact with austenitic stainless-steel operating at temperatures between 140°F and 250°F shall have a leachable chloride content in accordance with the limits set by ASTM C795 (Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel).
- C. Insulation materials for use on austenitic stainless-steel operating at temperatures between 140°F and 250°F shall be qualified as acceptable according to ASTM C 795. (Same reasoning as above)
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Pittsburgh Corning Corporation.
  2. Block Insulation: ASTM C 552, Type I.
  3. Special-Shaped Insulation: ASTM C 552, Type III.
  4. Board Insulation: ASTM C 552, Type IV.
  5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  6. Preformed Pipe Insulation with Factory-Applied ASJ, ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
  7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.

- c. K-Flex USA.
- H. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 1290, Type I.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Knauf Insulation.
    - d. Manson Insulation Inc.
    - e. Owens Corning.
- J. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Knauf Insulation.
    - c. Manson Insulation Inc.
    - d. Owens Corning.
  - 2. Type I, 850 deg. F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A.
  - 3. Type II, 1200 deg. F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A.
- K. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Owens Corning.

## 2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Ramco Insulation, Inc.

## 2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg. F.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Foster Brand; H. B. Fuller Construction Products.
  - 2. Adhesives shall have a VOC content of 50 g/L or less.

3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. K-Flex USA.
  2. Adhesives shall have a VOC content of 50 g/L or less.
  3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  2. Fiberglass adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  2. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. P.I.C. Plastics, Inc.
    - d. Speedline Corporation.
  2. Adhesive shall have a VOC content of 80 g/L or less (if available) when calculated



- according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.04 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  1. VOC Content: 420 g/L or less.
  2. Low-Emitting Materials: Mastic coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Foster Brand; H. B. Fuller Construction Products.
    - b. Knauf Insulation.
    - c. Vimasco Corporation.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg. F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.

## 2.05 SEALANTS

- A. Joint Sealants:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
    - e. Pittsburgh Corning Corporation.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg. F.
  5. Color: White or gray.
  6. Sealant shall have a VOC content of 420 g/L or less.
  7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.

- c. Foster Brand; H. B. Fuller Construction Products.
    - d. Mon-Eco Industries, Inc.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg. F.
  - 5. Color: Aluminum.
  - 6. Sealant shall have a VOC content of 420 g/L or less.
  - 7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg. F.
  - 5. Color: White.
  - 6. Sealant shall have a VOC content of 420 g/L or less.
  - 7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.06 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. P.I.C. Plastics, Inc.
    - c. Proto Corporation.
    - d. Speedline Corporation.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: White.
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45 and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Polyguard Products, Inc.

- E. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Johns Manville; Saranex 540CX Vapor Retarder Film.
- F. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Johns Manville; Saranex 540CX Vapor Retarder Film.
- G. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Johns Manville; Saranex 540CX Vapor Retarder Film or Saranex 560CX Vapor Retarder Film.

## 2.07 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
    - e. Venture Tape.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces' force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
    - e. Venture Tape.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces' force/inch in width.
  - 5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Compac Corporation.
    - b. Ideal Tape Co., Inc., an American Biltrite Company.
    - c. Venture Tape.
    - d. PVC Z-Tape, Z-Tape II, Johns Manville, a Berkshire-Hathaway Company
  2. Width: 2 inches.
  3. Thickness: 6 mils. (5-10 mil)
  4. Adhesion: 64 ounces' force/inch in width or (14-64 oz)
  5. Elongation: 150 -500 percent.
  6. Tensile Strength: 18 lbf/inch in width or (15-27 lbf/inch)
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Compac Corporation.
    - c. Ideal Tape Co., Inc., an American Biltrite Company.
    - d. Knauf Insulation.
    - e. Venture Tape.
  2. Width: 2 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces' force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.
- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. ITW Insulation Systems; Illinois Tool Works, Inc.
  2. Width: 3 inches.
  3. Film Thickness: 4 mils.
  4. Adhesive Thickness: 1.5 mils.
  5. Elongation at Break: 145 percent.
  6. Tensile Strength: 55 lbf/inch in width.
- F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. PVDC Tape for Indoor and outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive. (Since PVDC is not suitable for being left exposed outdoors, it is not the thickness that determines what thickness should be used but, rather, the desired permeance which is largely a factor of the pipe temperature. I recommend making this section applicable to both indoor and outdoor applications of PVDC Tape since the same tapes can be used in either application.)  
See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Division 01 Section "Product Requirements."  
Products: Subject to compliance with requirements, [provide the following]

[provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

Johns Manville; Saranex 520CX Vapor Retarder Tape or Saranex 560CX Vapor Retarder Tape.

2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

## 2.08 SECUREMENTS

- A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, with wing seal.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville
    - b. RPR Products, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel, or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. C & F Wire.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Install outermost layer of insulation with longitudinal seams at the 3:00 and 9:00 positions of horizontal runs. (Longitudinal seams should be at the sides of horizontal pipe to avoid being stressed from pipe supports, being walked on, having things hung from the insulated pipe, etc. If there will be stresses applied to insulated pipe, it is most likely to be at the top or bottom of the pipe so you do not want to have the joints in the outermost layer at these locations). Check with manufacturer depending upon application.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Jackets without a self-sealing lap are typically stapled or taped. Jackets like an ASJ jacket that have a self-sealing Lap adhesive system are not usually stapled for indoor applications. For below ambient air systems, any penetrations made in the vapor-retarder jacket needs to be sealed with appropriate vapor-retarder tape or mastic.
  - 4. Overlap jacket longitudinal seams at least 1 ½ inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 5. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

### 3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids,

- and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its



attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.06 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  1. Use the ASL-SSL pressure sensitive adhesive lap seal, and butt (circumferential) strips to seal the seams and joints respectively. Penetrations can be sealed with pressure-sensitive adhesive tape or vapor-retarder mastic. Follow manufacturer's instructions, which include sealing lap seal and butt strips having pressure-sensitive adhesive surfaces. When adhered, the lap and butt strips must be pressurized by rubbing firmly with a plastic squeegee or the back of a knife blade to ensure positive closure. For specific installations, secure each layer of Unfaced preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials. Check with manufacturer for instructions.
  2. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten

- bands without deforming insulation materials.
- 3. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
- 4. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
- 5. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.

### 3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1 ½ -inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. On horizontal pipe, overlap longitudinal seams arranged to shed water and locate longitudinal seams at 3:00 or 9:00 position on pipe. Seal end joints with weatherproof sealant recommended by insulation manufacturer. On vertical pipe, overlap end joint seams arranged to shed water and locate longitudinal joints to face away from prevailing wind.

Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints. Where PVDC jackets are indicated, install as follows: Apply wraps of filament tape at ends of each insulation section and on 12 inch centers to secure pipe insulation to pipe prior to installation of PVDC jacket.

Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.

Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.

Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33 1/2 - inches or less. The 33 1/2 -inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.
6. Geothermal heat pump supply and return piping.

### 3.08 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: [Flexible elastomeric] [Polyolefin], [1 inch] thick.
- C. Condensate Piping: Flexible elastomeric, 1 inch thick.

### 3.09 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be [ one of] the following:
  - 1. Cellular Glass: 2 inches thick.
  - 2. Flexible Elastomeric: 2 inches thick.
  - 3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
  - 4. Polyolefin: 2 inches thick.
  - 5. PHFA Requirement: All exposed refrigerant piping, power, and control wiring extending from the building to the remote condensing unit shall be protected and insulated with split type insulation with PVC jacket and cemented joints.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be [ one of] the following:
  - 1. Flexible Elastomeric: 2 inches thick.
  - 2. Polyolefin: 2 inches thick.
  - 3. PHFA Requirement: All exposed refrigerant piping, power, and control wiring extending from the building to the remote condensing unit shall be protected and insulated with split type insulation with PVC jacket and cemented joints.

### 3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  - 1. None.
  - 2. PVC: 20 mils thick.
- D. Piping, Exposed:
  - 1. PVC: 20 mils thick.

### 3.11 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION

**SECTION 23 09 33 - AUTOMATIC TEMPERATURE CONTROL****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 23 05 00 for requirements which are applicable to this section.
- B. Refer to International Mechanical Code.
- C. Refer to National Electrical Code.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to install a complete, functioning, Automatic Temperature Control (ATC) system.
- B. Power wiring will be provided under the Electrical portion of the work.
- C. Control wiring shall be furnished under this portion of the work. Control wiring is line voltage or low voltage if it performs as control wiring. Power for operation of valves and dampers is considered control wiring.
- D. ATC contractor/mechanical contractor to arrange for power for control equipment with electrical contractor. Allow for compensation to the electrical contractor to install a power source which may be required.
- E. The mechanical contractor shall be responsible for the complete coordination of all parts of the ATC system whether they be part of packaged control systems within units or built-up systems by ATC providers. It is the intent that all systems and subsystems to be coordinated and to be provided to produce the following sequences described in this specification.
- F. All control wiring shall be CAT 6 plenum rated. All control wiring shall run concealed in finished spaces. Control wiring to be in conduit in exposed interior unfinished areas and where subject to damage. All exterior exposed control wiring to be in conduit and weather protected. Conduit to be EMT. No pvc piping is permitted in plenums.
- G. Exposed control wiring is not acceptable.
- H. ATC contractor to be present at equipment/system start-up and verify that all wiring and components are installed correctly and the equipment/system sequence of operation is operating as designed. ATC contractor to perform final calibrations of all devices and equipment. ATC contractor to make all the required corrections if the equipment/system does not operate correctly.
- I. ATC contractor to coordinate with the test, balancing, and adjusting (TBA) contractor prior to performing equipment/systems tests that all air systems have been tested and balanced.

**1.03 SUBMITTALS**

- A. Submit shop drawings of all components.
- B. Submit manufacturers' data sheets of valve Cv performance.
- C. Submit design data and sequence of operations descriptions for all systems.
- D. Submit wiring diagrams of electrical or electronic control systems.
- E. At the completion of the project, submit final "as-built" drawings/CAD disk, all associated component/equipment cut-sheets/submittals, wiring diagrams, and final/actual sequence of operations descriptions of each system. Include ATC emergency contact information.

#### 1.04 QUALITY ASSURANCE

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Work shall be performed by skilled tradesmen normally engaged in the control systems trade.

### PART 2 - PRODUCTS

#### 2.01 CONTROL DEVICES - GENERAL

- A. All control devices and products used in the control system shall be first-line products, manufactured for the application as used.
- B. All thermostats shall have guards. Thermostat guards shall be plastic or metal covers to prevent tampering with the instrument. Provide substantial, locked, opaque cover, hinged to a base which is secured to the wall, not to the thermostat base.

#### 2.02 ECONOMIZER

- A. HVAC units shall be provided with economizer controls where indicated on the drawings or elsewhere in these specifications or on any system 4 tons or over. Enthalpy selection system shall consist of one enthalpy transmitter in the outside air, one enthalpy transmitter in the return air, and a relay to select the lower of the two enthalpies. In operation, the signal from the two enthalpy transmitters shall be compared by the differential switching relay so that when the outside air enthalpy is lower than the return air enthalpy, the temperature control system shall modulate the outside, return, and relief dampers to supply up to 100% outside air for "free cooling". When the outside air enthalpy is higher than the return air, the system shall position to minimum outside air. The use of separate temperature and humidity transmitters to arrive at enthalpy is not acceptable. Outside air transmitter shall not be damaged by operation during fog conditions.
- B. The economizer module shall be ASHRAE 90.1 compliant (latest version).
- C. The module shall have a local display screen for diagnostics at the unit.
- D. The module shall have fault detection diagnostics.
- E. Manufacturer: Belimo Zip Economizer series. Equal by Honeywell.

#### 2.03 CONTROL DEVICES - ELECTRICAL

- A. All electrical wiring for the control system shall be as specified in this section and the Electrical Section of the Specifications and as required by local codes. The wiring shall be by this contractor.
- B. Electric thermostats shall be low-voltage, modulating type to control modulating devices, or low- or line-voltage type with heat anticipator for two-position controls. Provide locking covers (clear plastic, hinged type).
- C. All thermostats to be 24hr./7 day programmable type, auto changeover type, +/-3 degree adjustment capability (when integrated with building automation system), WIFI capability. Manufacturer: Honeywell. Provide locking cover (clear plastic, hinged type).

#### 2.04 ACCEPTABLE MANUFACTURERS

- A. Control equipment shall be manufactured by a company regularly engaged in production of this type of equipment, as shown on the drawings, or equivalent equipment by Honeywell, Johnson Controls, Alerton, Schneider Electric, Delta, or prior approved equals.

#### 2.05 DAMPER AND VALVE ACTUATORS

- A. All damper actuators (motors) installed in conjunction with an Air Handler/HVAC unit must be of the spring return, 2 position, occupied/unoccupied type, or modulating where an economizer cycle is required.
- B. Combustion air damper actuators shall be of the 2 position, spring return type.

#### 2.06 RELAYS AND SIGNAL TRANSMITTERS

- A. All necessary relays, contacts, and interface devices shall be furnished to make the system a full and operable system.

#### 2.07 DUCT SMOKE DETECTORS

- A. Duct smoke detectors shall be of the photo-electronic type with sampling tube of ample length to traverse the entire width of the duct. Duct smoke detectors shall be manufactured by the control companies, the fire alarm companies, B.R.K. Electronics or approved equal. All HVAC units of 2000 CFM or more shall have duct smoke detectors in both the supply and return air streams. A single duct smoke detection in the return air stream shall be provided only when acceptable to the local authority having jurisdiction.
- B. Duct smoke detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity and alarm condition, and individually adjustable for sensitivity from the FACP.
- C. Units of 15,000 CFM or more shall have two detectors. (supply and return air)
- D. Furnish and install where indicated on the drawings or required elsewhere in the specifications air duct smoke detectors. They shall integrate photoelectric, ionization and heat sensing technologies for optimum detection accuracy and to prevent unwanted alarms. Auxiliary contacts shall be provided to shut down the air handling unit fan. The detector shall output to a remote alarm indicator.
- E. Duct smoke detectors to be furnished by the mechanical contractor.
- F. Duct smoke detectors shall be installed by the mechanical contractor.
- G. Interconnection between the duct smoke detectors and fire alarm system shall be performed by the electrical contractor/fire alarm contractor.
- H. Control's integration to shut down the HVAC equipment in alarm shall be performed by the mechanical contractor/ATC contractor.

#### 2.08 FREEZESTATS

- A. The freezestat shall be of the vapor pressure type with a 20 foot minimum element. Element shall respond to the lowest temperature sensed by any one foot section.
- B. The freezestat shall be manual reset. Provide reset button and red indicator light. Location to be coordinated with architect.
- C. All coils (heating hot water, chilled water, condenser water/water source) with outside air and hot water in ducts or units shall have freezestats.

#### 2.09 MOTOR OPERATED DAMPERS

- A. The motor operated dampers shall be of the parallel blade type for all 2-position applications such as the combustion air dampers and of the opposed blade type for all modulating applications including the outside air dampers for the heating, air conditioning, and ventilating units.
- B. The damper frames shall be extruded aluminum not less than, 08" thick, thermally broken, roll-formed channel with prepunched slotted mounting holes. The damper blades shall be extruded aluminum insulated R-2.29.
- C. Bearings shall be composed of a Celcon inner bearing with aluminum hexagon blade pivot pin, rotating within a poly carbonate outer bearing inserted in the frame. The dampers shall be equal to Tamco series 9000 ECT for parallel blade dampers and for opposed blade dampers.
- D. Dampers shall have a closed leakage rate of not more than 1.4 CFM per sq. ft. for 3'x3' damper at 1" S.P leakage class 1A.

#### 2.10 DIFFERENTIAL PRESSURE SWITCH

- A. Differential pressure switches shall have adjustable set point and differential and be of the automatic reset, snap acting type as manufactured by Honeywell or approved equal.
- B. +/- 5% accuracy, -1 to +1" P.G.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. All control equipment shall be installed as recommended by the manufacturer and as required for service in the field. No equipment shall be concealed or covered by other equipment unless adequate provisions are made for service and replacement.
- B. All wiring shall be run in neat, straight lines to present a finished appearance. Multiple runs shall be supported on brackets and spaced to give access to each line. Any work not neatly installed shall be removed and replaced.
- C. All wires shall be color-coded and numbered on both ends of each conductor for easy identification. Colors and numbers shall not change in the middle of a run, unless an accessible junction box is provided. Provide numbered terminal strips in all control panels.
- D. Wiring diagrams shall be prepared for all electrical connections, showing the actual wire number and terminal identification as installed. No less than three copies of such diagrams shall be delivered to the engineer as-built drawings.
- E. Installation of all equipment shall be made by qualified mechanics familiar with control systems, forces involved, and their operation.
- F. All connections shall be made by technicians who are familiar with the operation of the equipment and the intent of the control designer.
- G. After all equipment is mounted and connected, the control engineer shall inspect the system and verify the correct operation and connection of all equipment. Any equipment found to be installed improperly or connected incorrectly shall be changed as required. After the system is installed correctly, all instruments shall be calibrated and set points fixed at the correct setting.

#### 3.02 TESTING/TRAINING



- A. At the time of final review, the control contractor shall instruct the owner in the proper operation and maintenance of the system as installed and demonstrate how the system is designed to perform.
- B. At completion of the training, the contractor shall submit a letter stating the owner has received proper training, date, time, and location of training and name of the trainee.
- C. Any system found to be out of calibration or functioning improperly at this time shall be corrected immediately and the correct functions of the entire system demonstrated to the satisfaction of the engineer.
- D. The ATC contractor shall provide two 2-hour training sessions for systems orientation, product maintenance, trouble shooting, and emergency contacts. ATC contractor to coordinate with owner/architect/engineer to determine representatives/designated staff to be present for the training.

### 3.03 WARRANTY PERIOD SERVICES

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance by owner.
- B. Within this period, upon notice by the Owner, any defects in the BAS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the ATC Contractor at no expense to the Owner.
- C. The ATC Contractor shall inspect, repair, replace, adjust and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The ATC Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work and description of the corrective actions taken. The report shall clearly certify that all systems/equipment are functioning correctly.
- D. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.
- E. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

## PART 4 - SEQUENCE OF OPERATIONS

### 1.01 ROOFTOP CONSTANT VOLUME HEAT PUMPS

- A. General
  - 1. Occupied/Unoccupied hours shall be determined by the BAS time clock.
  - 2. Rooftop unit shall be provided with a 24h/7day programmable thermostat for control of occupied and unoccupied cycles. Unit shall be capable of manual override of the time clock control.
- B. Operation
  - 1. The supply fan shall operate continuously in occupied hours and cycle in unoccupied hours/evening hours.
  - 2. Ventilation air - during occupied hours, the outside air damper shall be open. During unoccupied and evening hours, the outside air damper shall be closed.
  - 3. Economizer - when the outside air temperature is lower than the space air temperature and the outside air dewpoint temperature is below 55°F, the unit shall operate in 100% outside air mode with no mechanical cooling.
  - 4. Cooling - on a call for cooling, the unit shall operate the compressors to maintain

- 55°F (adj.) Leaving air temperature.
5. Dehumidification (hot gas reheat) - when the outdoor air temperature is between 55°F and 85°F, the hot gas reheat circuit shall operate to maintain a leaving air temperature of 75°F (adj.).
  6. Heating - on a call for heating, the unit shall reverse the refrigeration cycle and operate the compressors to maintain 70°F (adj.) in the space.
  7. Provide a duct smoke detector in each unit 2,000 CFM or over in the return air connection.
  8. Fire alarm shutdown – If the duct smoke detectors sense smoke, then any combination fire/smoke dampers shall close and the associated unit shall be de-energized. The unit shall not be permitted to operate until all trouble signals are cleared on the fire alarm system.

#### 1.02 VRF SYSTEM HEAT PUMP

- A. Refer to VRF specification section 28 81 20.

#### 1.03 DUCTLESS SPLIT SYSTEM

##### A. General

1. The indoor unit shall be furnished with a wireless, wall mounted programmable 24 hr./7-day thermostat. ATC contractor shall install and wire thermostat.
2. ATC contractor shall wire outdoor unit to the indoor unit.
3. The unit shall include a low ambient kit. ATC contractor shall wire the outside air temperature sensor.

##### B. Operation

1. Cooling - on a call for cooling, the indoor unit shall operate to maintain 72°F (adj.) in the space.

#### 1.04 SMOKE DAMPERS (SD) AND COMBINATION FIRE/SMOKE DAMPERS (FSD)

- A. Smoke dampers (SD) and combination fire/smoke dampers (FSD) shall be furnished by the mechanical contractor and installed by the mechanical contractor (or sheet metal sub-contractor). The electrical contractor shall provide 120V power to all smoke dampers and combination fire/smoke dampers (refer to electrical drawings). The fire alarm sub-contractor shall wire the smoke damper or combination fire/ smoke damper to the digital addressable fire alarm system.
- B. Refer to cover sheet or equipment schedules for smoke damper and combination fire/smoke damper specification. Smoke dampers and combination fire/smoke dampers shall be power open, spring closed type (fail closed).
- C. Smoke dampers and combination fire/smoke dampers shall be furnished with open / closed blade indication module (OCI). The fire alarm sub-contractor shall wire the OCI module to the addressable fire alarm system.
- D. Addressable duct mounted smoke detectors or full area smoke detection shall be provided for each smoke damper and combination fire/smoke damper in accordance with international mechanical code section 607.3.3.
- E. The addressable duct mounted smoke detectors shall be furnished by the fire alarm sub-contractor, mounted by the mechanical contractor and wired to the addressable fire alarm system by the fire alarm sub-contractor.

#### 1.05 CARBON DIOXIDE RESET

- A. Applies to: RTU.1 and RTU.2.
- B. Furnish and install a carbon dioxide space sensor which shall reset the outside air damper position to respond to occupancy carbon dioxide levels. Integrate with associated HVAC unit controls.
- C. Sensor shall be installed in a protective cover (clear plastic with locking cover). Coordinate final location with engineer.
- D. On a rise in carbon dioxide levels above the set point (700 PPM) the outside air damper shall gradually open.
- E. On a fall in carbon dioxide levels below the set point, the outside air damper shall gradually close.

#### 1.06 SUSPENDED UNIT HEATERS – ELECTRIC

- A. General - refer to equipment schedule for additional information.
- B. Provide a wall mounted thermostat which shall start and stop the unit heater to maintain space temperatures. Fan shall start and stop with heating element.
- C. Wiring of thermostat is control wiring to be provided by the Mechanical/ATC Contractor regardless of line or low voltage.
- D. Provide a wall-mounted thermostat which shall energize and de-energize the unit heater and associated fan to maintain space setpoint temperature.

#### 1.07 CABINET UNIT HEATERS - ELECTRIC

- A. General – Refer to equipment schedule for additional information.
- B. Provide an integral thermostat or wall mounted which shall energize and de-energize the electric radiation to satisfy space setpoint temperatures. Wiring the thermostat is control wiring to be provided by the Mechanical/ATC Contractor regardless of line or low voltage.
- C. Cabinet unit heaters in public areas such as stair towers, lobbies and vestibules shall be furnished with integral tamperproof unit mounted thermostats.

END OF SECTION

**SECTION 23 23 00 - REFRIGERANT PIPING****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Refrigerant pipes and fittings.
  - 2. Refrigerant piping valves and specialties.
  - 3. Refrigerants.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.
- B. Sustainable Design Submittals:
  - 1. Product Data for EA Prerequisite 3, "Fundamental Refrigerant Management": For refrigerants, indicating compliance with refrigerant management practices.
- C. Shop Drawings:
  - 1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
  - 2. Show interface and spatial relationships between piping and equipment.
  - 3. Shop Drawing Scale: 1/4 inch equals 1 foot.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

**1.05 QUALITY ASSURANCE**

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

**PART 2 - PRODUCTS****2.01 PERFORMANCE REQUIREMENTS**

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig.

2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

## 2.02 COPPER TUBE AND FITTINGS

- A. Copper Tube: [ASTM B 88, Type K or L (ASTM B 88M, Type A or B)] [ASTM B 280, Type ACR].
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8/A5.8M.
- F. Flexible Connectors:
  1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  2. End Connections: Socket ends.
  3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
  4. Working Pressure Rating: Factory test at minimum 500 psig.
  5. Maximum Operating Temperature: 250 deg. F.

## 2.03 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Heldon Products; Henry Technologies.
    - c. Parker - Sporlan Hannifin Corp.
    - d. Paul Mueller Company.
  2. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
  3. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
  4. Operator: Rising stem and hand wheel.
  5. Seat: Nylon.
  6. End Connections: Socket, union, or flanged.
  7. Working Pressure Rating: 500 psig.
  8. Maximum Operating Temperature: 275 deg. F.
- B. Packed-Angle Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Heldon Products; Henry Technologies.
    - c. Parker - Sporlan Hannifin Corp.
    - d. Paul Mueller Company.
  2. Body and Bonnet: Forged brass or cast bronze.
  3. Packing: Molded stem, back seating, and replaceable under pressure.
  4. Operator: Rising stem.
  5. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
  6. Seal Cap: Forged-brass or valox hex cap.
  7. End Connections: Socket, union, threaded, or flanged.

8. Working Pressure Rating: 500 psig.
  9. Maximum Operating Temperature: 275 deg. F.
- C. Check Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Emerson Climate Technologies.
    - c. Heldon Products; Henry Technologies.
    - d. Parker Hannifin Corp.
    - e. Paul Mueller Company.
  2. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
  3. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
  4. Piston: Removable polytetrafluoroethylene seat.
  5. Closing Spring: Stainless steel.
  6. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
  7. End Connections: Socket, union, threaded, or flanged.
  8. Maximum Opening Pressure: 0.50 psig.
  9. Working Pressure Rating: 500 psig.
  10. Maximum Operating Temperature: 275 deg. F.
- D. Service Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Emerson Climate Technologies.
    - c. Heldon Products; Henry Technologies.
    - d. Parker Hannifin Corp.
    - e. Paul Mueller Company.
    - f. Refrigeration Sales, Inc.
  2. Body: Forged brass with brass cap including key end to remove core.
  3. Core: Removable ball-type check valve with stainless-steel spring.
  4. Seat: Polytetrafluoroethylene.
  5. End Connections: Copper spring.
  6. Working Pressure Rating: 500 psig.
- E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Emerson Climate Technologies.
    - c. Heldon Products; Henry Technologies.
    - d. Parker Hannifin Corp.
    - e. Paul Mueller Company.
  2. Body and Bonnet: Plated steel.
  3. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  4. Seat: Polytetrafluoroethylene.
  5. End Connections: Threaded.
  6. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and [24] [115] [208]-V ac coil.
  7. Working Pressure Rating: 400 psig.
  8. Maximum Operating Temperature: 240 deg. F.
- F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and

labeled by an NRTL.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Heldon Products; Henry Technologies.
    - c. Parker - Sporlan Hannifin Corp.
    - d. Paul Mueller Company.
  2. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
  3. Piston, Closing Spring, and Seat Insert: Stainless steel.
  4. Seat: Polytetrafluoroethylene.
  5. End Connections: Threaded.
  6. Working Pressure Rating: 400 psig.
  7. Maximum Operating Temperature: 240 deg. F.
- G. Thermostatic Expansion Valves: Comply with AHRI 750.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Emerson Climate Technologies.
    - c. Parker - Sporlan Hannifin Corp.
  2. Body, Bonnet, and Seal Cap: Forged brass or steel.
  3. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  4. Packing and Gaskets: Non-asbestos.
  5. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  6. Suction Temperature: 40 deg. F
  7. Superheat: Adjustable
  8. Reverse-flow option (for heat-pump applications).
  9. End Connections: ODF female, sweat connection, flare.
  10. Working Pressure Rating: 700 psig for 410A, 450 psig for non-410A
  11. Equalizer: External
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Heldon Products; Henry Technologies.
    - c. Parker -sporlan Hannifin Corp.
  2. Body, Bonnet, and Seal Cap: Ductile iron or steel.
  3. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  4. Packing and Gaskets: Non-asbestos.
  5. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  6. Seat: Polytetrafluoroethylene.
  7. Equalizer: External
  8. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 120-V ac coil.
  9. End Connections: Socket. ODF female, sweat connection, flare.
  10. Set Pressure: 150 psi for 410A
  11. Throttling Range: Maximum 5 psig.
  12. Working Pressure Rating (max): 700 psig.
  13. Maximum Operating (fluid) Temperature: 240 deg. F.
  14. Max ambient Temperature: 120 deg. F
- I. Straight-Type Strainers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of

the following:

- a. Danfoss Inc.
  - b. Heldon Products; Henry Technologies.
  - c. Parker Hannifin Corp.
2. Body: Welded steel with corrosion-resistant coating.
  3. Screen: 100-mesh stainless steel.
  4. End Connections: Socket or flare.
  5. Working Pressure Rating: 500 psig.
  6. Maximum Operating Temperature: 275 deg. F.
- J. Angle-Type Strainers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Heldon Products; Henry Technologies.
    - c. Parker Hannifin Corp.
  2. Body: Forged brass or cast bronze.
  3. Drain Plug: Brass hex plug.
  4. Screen: 100-mesh monel.
  5. End Connections: Socket or flare.
  6. Working Pressure Rating: 500 psig.
  7. Maximum Operating Temperature: 275 deg. F.
- K. Moisture/Liquid Indicators:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Emerson Climate Technologies.
    - c. Heldon Products; Henry Technologies.
    - d. Parker – Sporlan Hannifin Corp.
  2. Body: Forged brass.
  3. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
  4. Indicator: Color coded to show moisture content in parts per million (ppm).
  5. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
  6. End Connections: Socket or flare.
  7. Working Pressure Rating: 650 psig
  8. Maximum Operating Temperature: 240 deg. F.
- L. Replaceable-Core Filter Dryers: Comply with AHRI 730.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Emerson Climate Technologies.
    - c. Heldon Products; Henry Technologies.
    - d. Parker Hannifin Corp.
  2. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
  3. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
  4. Desiccant Media: Molecular sieve, Activated alumina.
  5. End Connections: Socket.
  6. Access Ports: NPS 1/4-inch connections at entering and leaving sides for pressure differential measurement.
  7. Maximum Pressure Loss: 2 psig



8. Working Pressure Rating: 650psig
9. Maximum Operating Temperature: 240 deg. F.
- M. Permanent Filter Dryers: Comply with AHRI 730.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Danfoss Inc.
    - b. Emerson Climate Technologies.
    - c. Heldon Products; Henry Technologies.
    - d. Parker – Sporlan Hannifin Corp.
  2. Body and Cover: Painted-steel shell.
  3. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
  4. Desiccant Media: Molecular sieve, Activated alumina.
  5. End Connections: Socket
  6. Maximum Pressure Loss: 2 psig
  7. Working Pressure Rating: 650 psig
  8. Maximum Operating Temperature: 240 deg. F.

#### 2.04 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Arkema Inc.
    - b. DuPont Fluorochemicals Div.
    - c. Genetron Refrigerants; Honeywell International Inc.
    - d. Mexichem Fluor Inc.

### PART 3 - EXECUTION

#### 3.01 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR or Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type K (A) or Type L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
- E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, Type K (A), or Type L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.
- F. Safety-Relief-Valve Discharge Piping: Copper, Type ACR or Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- G. Safety-Relief-Valve Discharge Piping: Copper, Type K (A), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

- H. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, Type K (A), Type L (B), drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
- I. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, Type K (A) or Type L (B), drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

### 3.02 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless or packed-angle valves on inlet and outlet side of filter dryers.
- E. Install a full-size, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  - 1. Install valve so diaphragm case is warmer than bulb.
  - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
  - 3. If external equalizer lines are required, make connection downstream of the bulb location where it will reflect suction-line pressure at bulb location.
- H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:
  - 1. Solenoid valves.
  - 2. Thermostatic expansion valves.
  - 3. Hot-gas bypass valves.
  - 4. Compressor.
- K. Install filter dryers in liquid line between condenser and thermostatic expansion valve [, and in the suction line at the compressor].
- L. Install receivers sized to accommodate pump-down charge.
- M. Install flexible connectors (Vibration absorbers) at compressors.

### 3.03 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

### 3.04 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

### 3.05 HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
  - 1. NPS 1/2-inch: Maximum span, 60 inches; minimum rod, 1/4 inch.
  - 2. NPS 5/8-inch: Maximum span, 60 inches; minimum rod, 1/4 inch.
  - 3. NPS 1-inch: Maximum span, 72 inches; minimum rod, 1/4 inch.
  - 4. NPS 1 1/4 -inch: Maximum span, 96 inches; minimum rod, 3/8 inch.
  - 5. NPS 1 1/2 -inch: Maximum span, 96 inches; minimum rod, 3/8 inch.
  - 6. NPS 2-inch: Maximum span, 96 inches; minimum rod, 3/8 inch.
  - 7. NPS 2 1/2 -inch: Maximum span, 108 inches; minimum rod, 3/8 inch.
  - 8. NPS 3-inch: Maximum span, 10 feet; minimum rod, 3/8 inch.
  - 9. NPS 4-inch: Maximum span, 12 feet; minimum rod, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

### 3.06 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.
    - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
- B. Prepare test and inspection reports.

### 3.07 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

4. Charge system with a new filter-dryer core in charging line.

### 3.08 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  1. Open shutoff valves in condenser water circuit.
  2. Verify that compressor oil level is correct.
  3. Open compressor suction and discharge valves.
  4. Open refrigerant valves except bypass valves that are used for other purposes.
  5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

**SECTION 23 23 16 - APR CONTROL (RAWAL VALVE)****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 23 05 00 for requirements which are applicable to this section.
- B. Refer to International Mechanical Code and ASHRAE Refrigerant Handbook.
- C. Refer to manufacturers' sizing requirements and piping recommendations.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install complete, operating, variable capacity refrigeration system which is to include equipment, piping, and accessories. Contractor to place DX system into operation.
- B. Contact and coordinate work with Rawal Devices, Inc. engineers for proper application, selections, and installations of APR control valve.
- C. Coordinate work with manufacturers' refrigeration requirements and Specification Section 23 23 00.

**1.03 SUBMITTALS**

- A. Submit shop drawings of APR Control Valve and associated refrigeration accessories.
- B. Submit manufacturers' data sheets of capacities, pipe sizes, APR control valve sizes and selection.
- C. Submit piping diagrams of refrigeration systems which show lengths and elevations. This must be reviewed and approved by Rawal Devices, Inc.
- D. Submit total capacity of individual systems, number of compressors, number of circuits, compressor staging/steps of unloading, split or package system, diagram of refrigerant piping routing (particularly suction line), suction line sizing, and including any risers in routing from evaporator to condenser.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install systems and equipment in accordance with code requirements.
- C. Provide adequate supervision of labor force to see that installations are correct.

**PART 2 - PRODUCTS****2.01 APR CONTROLS**

- A. APR Control is used for capacity control in packaged or split system air conditioning applications. APR Controls shall be installed in systems designated to provide capacity

- modulation on the refrigeration circuits in the unit(s) for improved humidity control during partial load conditions.
- B. The APR Control is to be installed in the condensing section of the system in accordance with Rawal Devices, Inc. installation instructions or at the direction of Rawal Devices, Inc. engineers. ASHRAE refrigeration piping protocol must be adhered to when the condensing unit (in split system applications) is located above the evaporator, or any suction riser exists. The APR Control is a field installed device and shall be sized by Rawal Devices, Inc. engineers to confirm proper application.
  - C. APR Controls shall be by Rawal Devices, Inc., Waterbury, CT (800) 727-6447.

### PART 3 - EXECUTION

#### 3.01 GENERAL

- A. Contractor to pump down system and lock existing refrigerant in the receiver or condenser. If cannot secure existing system charge, use a recovery unit to save and store the refrigerant charge.
- B. Do not release refrigerant into the atmosphere. Before installing the APR Control make sure your system is clean. If not, or in doubt, a filter strainer must be used to protect the APR Control and isolate and remove the system contaminants. (Particles of dirt can settle on the valve seat of the hot gas bypass valve and prevent it from closing, possibly causing compressor overheating and subsequent system damage.)
- C. After installing the APR Control, use standard evacuation procedures and follow the direction listed below. All connections between the system and the APR Control are made in the condensing section. The APR Control may be placed outside the unit housing. The APR Control may be mounted vertical or horizontally.
  - 1. NOTE: If the APR Control is mounted vertically - the mixed gas discharge from the top of the desuperheating chamber must be UP! Using line valves to isolate the APR Control inlet liquid, hot gas and external equalizer connections, and outlet mixed gas discharge line, is recommended but optional, and not functionally required.
- D. All soldering connections to the APR Control should be made with Type 400 6% Silver (20°C) Solder only. Do not hard solder or silver solder APR Control connections to your system. Exceptions can be made where vibration or pulsation is present or where Government specifications call for hard solder or braising.
- E. To eliminate damage to the APR Control Valves, use plenty of wet rags or Heat Absorbing Paste on the valves prior to starting, and aim flame away from the valve bodies.
- F. Tee in a line shut-off valve at the compressor hot gas discharge line - size valve to the APR Control hot gas inlet valve inlet - where a strainer is supplied, install it in the 5/8" or 7/8" hot gas valve inlet only.
- G. Tee in a line shutoff valve at the compressor suction line - size it to the APR Control mixer gas discharge (TOP) outlet either 5/8" or 7/8" ODF.
- H. Tee in line shutoff valve at the liquid line near the condenser coil or receiver outlet. Size this valve to the 3/8" ODF APR Control thermal expansion valve inlet.
- I. If the system uses PUMPDOWN or PUMPOUT control, the mixed gas line valve must be replaced by a solenoid valve with manual stem for shut off. The coil voltage should be the unit control voltage.
- J. Mount the APR Control securely within the condensing unit.

- K. Connect hot gas from the line valve to the APR Control hot gas bypass valve inlet.
- L. Connect suction from the line valve to the APR Control mixed gas outlet.
- M. Connect 3/8 liquid from the line valve to the APR Control thermal expansion valve inlet.
- N. External equalizers must be coupled for one suction line connection only.
- O. Thermal expansion valve bulb must be the last APR Control connection and nearest the compressor.
- P. Leak test system and evacuate. Before charging system close all APR control line valves.
- Q. APR Control open when charging the system. No additional charge is necessary for the APR Control to operate.
- R. APR Control is set at the factory for R-22/High Temperature application.
- S. Thermal Expansion Valve at 57°F (17° superheat).
- T. Hot Gas Bypass Valve at 58 psi pressure.
- U. APR Controls are field adjustable when necessary.

END OF SECTION



**SECTION 23 23 24 - REFRIGERANT LEAK DETECTION SYSTEM****PART 1 - GENERAL**

(In accordance with ASHRAE 15-2004 and CSA B-52 Mechanical Code)

- A. Provide a complete installation of a refrigerant leak detection system including a main control panel, sensors, audible/visual alarm devices and emergency break glass switches. This system can be linked to a Controller Unit or to a BAS.
- B. The system design shall consist of diffusion type sensors and a control unit. Sample draw systems with sample tubing are unacceptable.
- C. The system shall include, but not be limited to, the following:
  - 1. Future expandability
  - 2. Display of refrigerant gas concentration.
  - 3. Ability to modify alarm set points.
  - 4. Interlocking with emergency system shut down.
  - 5. Automatic and manual fan start/stop.
  - 6. Display of alarm status.
- D. Provide self-contained breathing apparatus (SCBA) as follows:
  - 1. One (1) unit will be provided and located immediately outside the mechanical room door.
  - 2. A second backup unit will also be provided.

**PART 2 - PRODUCTS****2.01 EXPANSION UNIT**

- A. The controller shall provide a 4 -20 mA output signal for each sensor corresponding to the measured refrigerant levels of each sensor. In the event of a sensor or controller malfunction, the controller shall energize an on board fault relay and turn on a fault indicator on the front panel.
- B. The controller shall continuously display the specified refrigerant concentration of each sensor via an LCD display. The controller shall have a minimum of three levels of activation for each detected refrigerant level. There shall be 3 relays corresponding to three alarm levels. The alarm A relay shall be energized and the first alarm (Alarm A) shall be initiated when the refrigerant concentration reaches or exceeds the programmed Alarm A level. Alarm A shall start the mechanical room ventilation equipment. The Alarm B relay shall be energized and the second alarm (Alarm B) shall be initiated when the refrigerant concentration levels reach or exceed the programmed Alarm B level. Alarm B shall energize an onboard red horn strobe unit attached to the controller or a remote red alarm horn strobe. All relays shall be form C, double pole double throw. Dry contacts shall be rated for 5 amps (resistive load) at 240 Vac.
- C. The controller shall provide an audible alarm silence button on the front panel to silence the audible alarm but will automatically reset and sound again at the next alarm occurrence.

- D. The controller shall be wall mount type with the following features:
1. Enclosure Type- The enclosure shall be NEMA 4 type. Access to the inside of the enclosure and wiring connections shall be through a front facing, full length door. The door shall have a window size sufficient to allow viewing of a 2 line by 20 character LCD display.
  2. Enclosure Size- the enclosure shall be no more than 12 inches in any dimension.
  3. Mounting Provisions – mounting brackets for the purpose of attaching the unit to a flat surface shall not be needed.
  4. Front Panel Controls- a four button keypad and fan start stop and alarm silence buttons shall provide access to all monitor functions including display, calibration, set-up and diagnostics.
  5. Audible Alarm – A 65dBa (at 3 feet) audible alarm shall be internal to the controller; it shall sound when one of the pre-selected alarm conditions occurs.
  6. No tools or special adapters shall be used for:
    - a. Display of alarm set point level on front panel readout.
    - b. Resetting any alarm set point.
    - c. Zero and Span calibration adjustments
  7. System Power Requirements – the system shall operate on 24Vac 2A max.

## 2.02 BACNET COMMUNICATIONS CAPABILITY

- A. Optional BACnet/IP communications capability can be provided to connect to a Building Automation System.

## 2.03 DETECTORS

- A. Operating Principal: the principal of operation shall be non-dispersive infrared type by Honeywell Analytics or prior approved equal.
1. Detector sample: The detector shall be of diffusion type with no internal sample pump or filter.
  2. Detector sensitivity: The detector shall be capable of monitoring over a range of 0-1000 ppm with a resolution of 1 ppm.
  3. Detector accuracy: The detector shall be capable of maintaining a response of  $\pm 8\%$  @ range of 500 ppm.
  4. Temperature- the system shall operate over a range of 0 to 40 degrees centigrade (32 to 104 degrees F).
  5. Stability- the 30 day zero and span drift shall be less than 1% F.S. without the aid of automatic or manual recalibration. The system shall not employ any type of auto-zero techniques in order to maintain stability. The use of fresh air sources or scrubbers as zero reference is not permitted.
  6. Calibration – The system must provide a menu driven method of checking both zero and span calibrations. Any adjustments must be made through the front panel keyboard.
  7. Maximum distance between the sensor and controller shall not exceed 200 ft (60 m).
  8. Maximum System Maintenance Requirements – The detectors shall require no periodic maintenance other than yearly zero and span checking with calibrated zero and span gas. Periodic checking or adjustments of the unit shall be capable of being accomplished by one person at the unit location.

Detector alarm levels are to be activated and the unit is to be installed in accordance with the following parameters:

**TOXIC GASES 1st ALARM****SET POINT**

(TLV-TWA) 2nd ALARM

**SET POINT**

(TLV-STEL) 3rd ALARM

**SET POINT****MOUNTING HEIGHT****COVERAGE**

Carbon Monoxide (CO)	25 ppm	200 ppm	225 ppm	5 ft. (150 cm) above finished floor	50 ft.
(15 m)					

Refrigerants	250 PPM	500 PPM	900 PPM	1 ft. (30 cm) above finished floor	1 per Chiller
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Local Building Codes recommendations have preference over these parameters. Coverage can differ depending on application.

**2.04 ACCESSORIES****A. Strobe and Horn**

Strobe and horn may be integral to the controller or remote mounted.

The remote mounted unit shall be rated at 85dba at 10 feet.

The integral horn strobe unit shall be rated at 90dba at 3 feet.

**B. Emergency break glass switches shall be provided.**

Break glass manual switches shall be equivalent to Honeywell Analytics, type EMBG or prior approved equal.

Self-Contained Breathing Apparatus

**C. SCBA must be equivalent to Honeywell Analytics NIOSH SCBA with the ability to be wall mounted using Honeywell Analytics wall mount case SCBA WALLCASE or prior approved equal.****PART 3 - EXECUTION****3.01 INSTALLATION****A. The Refrigerant Leak Detection system shall be installed complete and in accordance with the manufacturer's installation instructions.****3.02 COMMISSIONING****A. The Refrigerant Leak Detection system shall be inspected and commissioned on site by a factory trained and authorized technician. A factory generated certification document shall be presented certifying the operation of the unit and the alarm system.****3.03 WARRANTY.****A. The system shall be warranted by the manufacturer to be free from defects in workmanship and materials for a period of one year.**

END OF SECTION

**SECTION 23 31 13 - METAL DUCTS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Rectangular ducts and fittings.
  - 2. Round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Sound attenuating duct lining.
  - 5. Sealants and gaskets.
  - 6. Hangers and supports.
  - 7. Seismic-restraint devices.
- B. Related Sections:
  - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 233116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
  - 3. Section 233119 "HVAC Casings" for factory and field fabricated casings for mechanical equipment.
  - 4. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ANSI/ASHRAE 62.1.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Design Submittals:
  - 1. Product Data: For ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."
  - 2. Product Data: For adhesives, indicating VOC content.
  - 3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
  - 4. Product Data: For sealants, indicating VOC content.
  - 5. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings:
  - 1. Ductwork shop drawings must be properly submitted. Any ductwork installed without prior approval by the engineer and found to be incorrect, shall be replaced at the

- expense of the contractor.
2. Submit shop drawings of all sheet metal for review. Drawings shall be not less than 1/4" scale and show all light fixtures, steel, piping, conduit, equipment and architectural features. It is unacceptable to resubmit and modify McHugh design documents for sheet metal drawing purposes.
    - a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
    - b. Factory- and shop-fabricated ducts and fittings.
    - c. Duct layout indicating sizes, configuration, and static-pressure classes.
    - d. Elevation of top of ducts. Verify ductwork fits in available space.
    - e. Dimensions of main duct runs from building grid lines.
    - f. Fittings.
    - g. Reinforcement and spacing.
    - h. Seam and joint construction.
    - i. Penetrations through fire-rated and other partitions.
    - j. Equipment
    - k. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
    - l. Hangers and supports, including methods for duct and building attachment and vibration isolation.
    - m. Indicate waste and storm piping where it occurs in the area of ductwork.
    - n. Locate electrical gear on plan. Ductwork is not to run above panels.
    - o. Ductwork is to be shown double line with indicated width and height.
    - p. Allowance to be made for lining and/or insulation.
    - q. Duct sizes shown on contract drawings may be flattened to a 4 to 1 ratio when necessary to establish clearance. Such transitions are to be included in the contract price.
    - r. Ductwork fabrication shall not proceed until shop drawings are submitted for review.
    - s. All dampers, grilles, registers, diffusers, access panels, louvers, coils, filters, and other components of the system are to be indicated.
    - t. Provide detail of fire damper assembly.
    - u. Provide drawing sections when requested by the engineer.
    - v. Coordinate sheet metal drawings with light fixture layout and sprinkler system piping and heads and shown on the drawing.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
  2. Suspended ceiling components.
  3. Structural members to which duct will be attached.
  4. Size and location of initial access modules for acoustical tile.
  5. Penetrations of smoke barriers and fire-rated construction.
  6. Items penetrating finished ceiling including the following:
    - a. Luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.

- d. Sprinklers.
  - e. Access panels.
  - f. Perimeter moldings.
- B. Welding certificates.

#### 1.05 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
  - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.01 RECTANGULAR DUCTS AND FITTINGS – SMACNA STANDARDS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.02 FABRICATED DUCT REQUIREMENTS - DUCTMATE

- A. All interior rectangular ducts shall be constructed with G-60 or better galvanized steel (ASTM A-653-94) LFAQ, chem treat. Exterior ductwork shall be G-90 or better galvanized steel LFAQ, chem treat. Kitchen, shower, or dishwasher exhaust shall be aluminum with aluminum joints.
- B. Materials: Support, access doors not part of ducts, bar or angle reinforcing damper rods and items made of uncoated mild steel shall be painted with two coats of primer or provide galvanized equivalent.
- C. Longitudinal Seams. Pittsburgh lock shall be used on all longitudinal seams. All longitudinal

- seams will be sealed with mastic sealant. Snaplock is not acceptable.
- D. Flanged interior Gasket. Ductmate 440 or a Butyl Rubber Gasket which meets Mil-C 18969B, Type II Class B, TT-C-1796 A, Type II Class B, and TTS-S-001657 must also pass UL-723. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type of vehicle that will support fungal and/or bacterial growth associated with dark, damp areas of ductwork. The recommended test procedure for bacterial and fungal growth is found in 21CFR 177, 1210 closures with sealing gaskets for food containers.
  - E. Ductmate or W.D.C.I. proprietary duct connection systems will be accepted. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.
  - F. Formed - on flanges (T.D.C./T.D.F./T-25A/T-25B) be accepted. Formed on flanges will be constructed as SMACNA T-25 flanges, whose limits are defined on page 1.36 1995 SMACNA Manual, Second Edition. No other construction pertaining to formed - on flanges will be accepted. Formed on flanges shall be accepted for use on ductwork 42" wide or less and must include the use of corners, bolts, and cleat. (Over 42", the reinforcement/joint deflection criteria no longer conform with the UMC).
  - G. All ductwork in moist areas (Toilet Rooms, locker rooms, etc) shall be aluminum construction with aluminum hangers, supports, and fasteners.

## 2.03 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ductmate Industries, Inc.
    - b. Elgen Manufacturing.
    - c. Linx Industries (formerly Lindab).
    - d. McGill AirFlow LLC.
    - e. MKT Metal Manufacturing.
    - f. SEMCO LLC.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Provide double wall with 1" insulation and perforated liner for all exposed round air

conditioning supply ducts.

## 2.04 SOUND ATTENUATING DUCT LINING

### A. Includes:

1. All interior supply air ductwork.
2. Return ductwork: Line the first 10'-0" of the main return ductwork extending from the air handling units.

**\*\* NOTE:** Refer to ductwork insulation specification (23 07 13) for insulation requirements. Lining indicated is in addition to insulation requirements.

- B. Duct liner shall have a flame spread of not over 25, a fuel contributed of not over 50 and a smoke developed of not over 50.
- C. Liner shall be minimum 1 inch thick, 1.5 Lbs./Cu. Ft. density with a thermal conductance of .24 at 50 deg. F. mean temperature. (Conductance: BTU/Sq. Ft./F/Hr.).
- D. Liner shall not spall or deteriorate at air velocities to 4000 FPM when installed in accordance with the manufacturer's recommendations.
- E. Liner shall be Johns-Manville Linacoustic or approved substitute by Owens-Corning, CertainTeed, or Knauf. Observe all installation instructions.
- F. Any ductwork in unconditioned spaces or outdoors shall have insulation totaling R-8.3.

## 2.05 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation For Interior Ductwork: G60.
  - 2. Galvanized Coating Designation For Exterior Ductwork: G90.
  - 3. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- G. Fiberglass ductboard is not acceptable.

## 2.06 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
  - 1. Application Method: Brush on.
  - 2. Solids Content: Minimum 65 percent.



3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
  6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.07 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.02 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
  - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg:

Seal Class B.

- 11. Conditioned Space, Exhaust Ducts: Seal Class B.
- 12. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.03 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.04 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.05 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.06 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
  - 1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior.
- B. Supply Ducts:
  - 1. All Supply Ductwork:
    - a. Pressure Class: Positive 2-inch wg.
    - b. Minimum SMACNA Seal Class: C for 0-2"; B for 3"; A for 4", 6", 10".

- c. SMACNA Leakage Class for Rectangular: 16 for 0-2"; 8 for 3"; 4 for 4",6",10".
  - d. SMACNA Leakage Class for Round and Flat Oval: 8 for 0-2"; 4 for 3"; 2 for 4",6",10".
- C. Return Ducts:
  - 1. All Return Ductwork:
    - a. Pressure Class: Positive or negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: C.
    - c. SMACNA Leakage Class for Rectangular: 16.
    - d. SMACNA Leakage Class for Round and Flat Oval: 8.
- D. Exhaust Ducts:
  - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 8.
- E. Intermediate Reinforcement:
  - 1. Galvanized-Steel Ducts: Galvanized steel.
  - 2. PVC-Coated Ducts:
    - a. Exposed to Airstream: Match duct material.
    - b. Not Exposed to Airstream: Galvanized.
  - 3. Stainless-Steel Ducts:
    - a. Exposed to Airstream: Match duct material.
    - b. Not Exposed to Airstream: Galvanized.
  - 4. Aluminum Ducts: [Aluminum] [or galvanized sheet steel coated with zinc chromate].
- F. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm:
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      - 4) Radius-to Diameter Ratio: 1.5.
    - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- G. Branch Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: Spin in.
  - 2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm or Lower: 90-degree tap.
    - b. Velocity 1000 to 1500 fpm: Conical tap.
    - c. Velocity 1500 fpm or Higher: 45-degree lateral.
- H. General Requirements
  - 1. Ductwork in the pool and pool equipment room shall be aluminum construction with aluminum hangers, supports, and fasteners.
  - 2. Rectangular ductwork above the roof or outside shall be 4" water gauge construction.
- I. Rectangular ductwork in the pool and pool equipment room shall be aluminum construction with stainless steel (317L or 904L) hangers, supports, and fasteners.
  - 1. All ductwork in moist areas (Toilet Rooms, locker rooms, kitchens, etc.) shall be aluminum construction with aluminum hangers, supports, and fasteners.

END OF SECTION

**SECTION 23 33 00 - AIR DUCT ACCESSORIES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Backdraft and pressure relief dampers.
  - 2. Manual volume dampers.
  - 3. Control dampers.
  - 4. Fire dampers.
  - 5. Smoke dampers.
  - 6. Flange connectors.
  - 7. Turning vanes.
  - 8. Duct-mounted access doors.
  - 9. Flexible connectors.
  - 10. Duct accessory hardware.
- B. Related Requirements:
  - 1. Section 283000 "Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product data showing compliance with ASHRAE 62.1.
  - 2. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control-damper installations.
    - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
    - e. Wiring Diagrams: For power, signal, and control wiring.

**1.03 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**PART 2 - PRODUCTS****2.01 ASSEMBLY DESCRIPTION**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with

- B. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."  
Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

## 2.02 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.  
1. Galvanized Coating Designation: G60 for indoor applications and G90 for exterior applications.  
2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.03 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:  
1. American Warming and Ventilating; a Mestek Architectural Group company.  
2. Greenheck Fan Corporation.  
3. Lloyd Industries, Inc.  
4. Nailor Industries Inc.  
5. NCA Manufacturing, Inc.  
6. Pottorff.  
7. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2500 fpm.
- D. Maximum System Pressure: 2-inch wg
- E. Frame: Hat-shaped, 0.063-inch-thick extruded aluminum or 0.05-inch-thick stainless steel, with welded corners or mechanically attached and mounting flange.
- F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.050-inch-thick aluminum sheet with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Extruded vinyl, mechanically locked or Neoprene, mechanically locked.
- I. Blade Axles:  
1. Material: Stainless steel.  
2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.
- L. Bearings: Synthetic pivot bushings.
- M. Accessories:  
1. Adjustment device to permit setting for varying differential static pressure.  
2. Counterweights and spring-assist kits for vertical airflow installations.

3. Screen Mounting: Rear mounted.
  4. Screen Material: Aluminum.
  5. Screen Type: Insect.
  6. 90-degree stops.
- N. Air Leakage: Class I – Not to exceed 8 CFM/FT<sup>2</sup> @ 4" w.g. AMCA Certified.

## 2.04 MANUAL VOLUME DAMPERS

### A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Warming and Ventilating; a Mestek Architectural Group company.
  - b. Flexmaster U.S.A., Inc.
  - c. McGill AirFlow LLC.
  - d. Nailor Industries Inc.
  - e. Pottorff.
  - f. Ruskin Company.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
  - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
  - b. Mitered and welded corners.
  - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
  - a. Molded synthetic.
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

### B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Warming and Ventilating; a Mestek Architectural Group company.
  - b. McGill AirFlow LLC.
  - c. Nailor Industries Inc.
  - d. Pottorff.
  - e. Ruskin Company.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
  - a. Multiple or single blade.
  - b. Parallel or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.



- e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
- 6. Blade Axles: [Galvanized steel] [Stainless steel] [Nonferrous metal].
- 7. Bearings:
  - a. [Oil-impregnated bronze] [Molded synthetic] [Stainless-steel sleeve].
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Aluminum.
- C. Jackshaft:
  - 1. Size: 1-inch diameter.
  - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- D. Damper Hardware:
  - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
  - 2. Include center hole to suit damper operating-rod size.
  - 3. Include elevated platform for insulated duct mounting.

## 2.05 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating; a Mestek Architectural Group company.
  - 2. Arrow United Industries.
  - 3. Greenheck Fan Corporation.
  - 4. Lloyd Industries, Inc.
  - 5. McGill AirFlow LLC.
  - 6. Metal Form Manufacturing, Inc.
  - 7. Nailor Industries Inc.
  - 8. Pottorff.
  - 9. Ruskin Company.
  - 10. Tamco
  - 11. Young Regulator Company.
- B. Frames:
  - 1. Hat, U, or Angle shaped.
  - 2. 0.05-inch thick stainless steel.
  - 3. Mitered and welded corners.
- C. Blades:
  - 1. Multiple blade with maximum blade width of 6 inches.
  - 2. Opposed blade design.
  - 3. Aluminum.
  - 4. 0.0747-inch- thick dual skin.
  - 5. Blade Edging: Closed-cell neoprene.
  - 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- D. Blade Axles: 1/2-inch-diameter; nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
  - 1. Operating Temperature Range: From minus 40 to plus 200 deg. F.
- E. Bearings:
  - 1. Molded synthetic.
  - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full

- length of damper blades and bearings at both ends of operating shaft.
- 3. Thrust bearings at each end of every blade.
- F. Air Leakage: Class I – Not to exceed 8 CFM/FT2 @ 4"w.g.. AMCA Certified.

## 2.06 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating; a Mestek Architectural Group company.
  - 2. Arrow United Industries.
  - 3. Greenheck Fan Corporation.
  - 4. Nailor Industries Inc.
  - 5. Pottorff.
  - 6. Ruskin Company.
  - 7. Vent Products Co., Inc.
- B. Type: Static; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2500-fpm velocity.
- D. Fire Rating: 1 ½ and 3 hours. Coordinate with wall rating.
- E. Frame: Curtain type with blades inside airstream for duct heights larger than 14" and curtain type with blades outside airstream for duct heights 14" and below; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
  - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg. F rated, fusible links. Provide 10 % extra links to the owner.
- K. SET FIRE DAMPERS IN 20 GAUGE SLEEVES WITH BREAKAWAY CONNECTIONS TO THE DUCTWORK ON EACH SIDE. SEE STANDARD SMACNA DETAILS FOR INSTALLATION. DAMPERS INSTALLED INCORRECTLY WILL BE REQUIRED TO BE REMOVED AND REPLACED CORRECTLY.
- L. Provide 12" x 12" access door in ductwork for access to each damper. Label "FIRE DAMPER ACCESS" with 2" high stenciled letters.

## 2.07 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating; a Mestek Architectural Group company.
  - 2. Greenheck Fan Corporation.
  - 3. Nailor Industries Inc.
  - 4. Pottorff.
  - 5. Ruskin Company.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Shall be provided by the Fire Alarm Contractor / Electrical Contractor and installed by the Mechanical Contractor.

- D. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with interlocking, gusseted or mechanically attached corners and mounting flange.
- E. Blades: Roll-formed, horizontal, interlocking, 0.063-inch thick, galvanized sheet steel.
- F. Leakage: Class I.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, 0.05-inch thick, galvanized sheet steel; length to suit wall or floor application [ with factory-furnished silicone caulking].
- I. Damper Motors: two-position action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
  - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg. F.
  - 6. Nonspring-Return Motors: For damper's larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
  - 7. Electrical Connection: 24 V.

## 2.08 COMBINATION SMOKE/FIRE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating; a Mestek Architectural Group company.
  - 2. Greenheck Fan Corporation.
  - 3. Nailor Industries Inc.
  - 4. Pottorff.
  - 5. Ruskin Company.
- B. General Requirements:
  - 1. Dampers shall be furnished with both the 1 1/2 hour (or 3 hour) UL label for fire dampers - UL 555 and the UL label for leakage resistance (smoke) - UL 555S.
  - 2. Refer to the requirements of Fire Dampers and Smoke Dampers for additional requirements.

## 2.09 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
- B. Description: Roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

## 2.10 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Aero-Dyne Sound Control Co.
  - 2. Ductmate Industries, Inc.
  - 3. Duro Dyne Inc.
  - 4. Elgen Manufacturing.
  - 5. Hardcast, Inc.
  - 6. METALAIRE, Inc.
  - 7. SEMCO LLC.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.

## 2.11 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating; a Mestek Architectural Group company.
  - 2. Ductmate Industries, Inc.
  - 3. Elgen Manufacturing.
  - 4. Flexmaster U.S.A., Inc.
  - 5. Greenheck Fan Corporation.
  - 6. McGill AirFlow LLC.
  - 7. Nailor Industries Inc.
  - 8. Pottorff.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
  - 1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.
    - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
    - e. Fabricate doors airtight and suitable for duct pressure class.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  - 3. Number of Hinges and Locks:
    - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

- b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
- c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside handles.
- d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside handles.

## 2.12 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. 3M.
  - 2. Ductmate Industries, Inc.
  - 3. Flame Gard, Inc.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg. F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

## 2.13 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Elgen Manufacturing.
  - 3. Hardcast, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5 ¾ inches wide attached to two strips of 2 ¾ -inch-wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd.
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg. F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd.
  - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg. F.

## 2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## 2.15 ABOVE THE ROOF DUCT CURBS

- A. Furnish and install - RPS Duct Mounting Pedestals as manufactured by RPS Products and Systems Corp., Bensenville, IL at all necessary specified points or as shown on drawings. The duct mounting pedestal shall include an equipment rail, a matching length steel slide channel attached to "U" shaped mounting brackets and secured to side of equipment rail with lag bolts. The duct mounting assembly shall have galvanized 18' long continuous threaded rods for 12" vertical adjustment, lateral adjust spacer bracket for 12" horizontal adjustment, and galvanized slide assembly.

## 2.16 BURGLAR BARS

Furnish and install steel burglar bars in roof curbs. Bars shall be minimum 1/2" x 1/2" steel on 6" centers, permanently attached in roof curb.

## 2.17 VOLUME DAMPER CONTROL - REMOTE EXTERNAL CONTROL

Applications: Drywall ceilings or where shown on drawings.

1. Location: In ductwork where required to control air flow or balance air systems.
2. Volume Damper Type: Opposed single blade round butterfly damper for external control, EPDM low leakage seals, scoop and spin-in type shell, Young Regulator Co. 5020 CC Series. Rectangular: #830-CC Series.
3. Leakage: 10 CFM maximum at 4" s.p. for 4 square dampers.
4. Material: Galvanized steel in galvanized steel ductwork, extruded aluminum in aluminum ductwork.
5. Controls: Bowden Cable Control Kit 270-896C to include hardware, for ceiling mounting in conjunction with external control of round or rectangular dampers, flush 7/8" diameter cold rolled steel cover is zinc plated for painting, 12" wrench (damper adjustments), metal clad control cable.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft or control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  1. Install steel volume dampers in steel ducts.
  2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.

- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On both sides of duct coils.
  - 2. Upstream from duct filters.
  - 3. At outdoor-air intakes and mixed-air plenums.
  - 4. At drain pans and seals.
  - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
  - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  - 7. At each change in direction and at maximum 50-foot spacing.
  - 8. Upstream from turning vanes.
  - 9. Upstream or downstream from duct silencers.
  - 10. Control devices requiring inspection.
  - 11. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8 by 5 inches.
  - 2. Two-Hand Access: 12 by 6 inches.
  - 3. Head and Hand Access: 18 by 10 inches.
  - 4. Head and Shoulders Access: 21 by 14 inches.
  - 5. Body Access: 25 by 14 inches.
  - 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- N. Connect diffusers or light troffer boots to ducts with maximum 10 feet lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.
- Q. Install volume damper control – remote external control when balancing dampers are located above in accessible ceilings similar to gypsum board.

### 3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  - 4. Inspect turning vanes for proper and secure installation.

END OF SECTION



**SECTION 23 33 46 - FLEXIBLE DUCTS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Insulated supply flexible ducts.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product data showing compliance with ASHRAE 62.1.
  - 2. Product Data: For adhesives and sealants, indicating VOC content.
  - 3. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
  - 4. Laboratory Test Reports: For Insulation, indicating compliance with requirements for low-emitting materials.
  - 5. Product Data: For insulation, indicating that R-values comply with tables in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
- C. Shop Drawings: For flexible ducts.
  - 1. Include plans showing locations and mounting and attachment details.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

**PART 2 - PRODUCTS****2.01 ASSEMBLY DESCRIPTION**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

**2.02 INSULATED FLEXIBLE DUCTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flexmaster U.S.A., Inc.
  - 2. Flex-Tek Group.

3. McGill AirFlow LLC.
  4. Thermaflex.
  5. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene [aluminized] vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 10-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.
  3. Temperature Range: Minus 20 to plus 210 deg. F.
  4. Insulation R-Value: Comply with ASHRAE/IES 90.1 - R4.2 in conditioned space, R8.0 in unconditioned space/outdoors.
  5. Comply with 25/50 flame spread and smoke density ratings.

### 2.03 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Applies to supply ductwork only. Exhaust and return ductwork to be rigid ductwork.
- C. Flexible air connectors and flexible ducts shall not be used to make 90 degree or greater.
- D. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- E. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- F. Connect diffusers or light troffer boots to ducts with maximum 10'-0" lengths of flexible duct clamped or strapped in place.
- G. Connect flexible ducts to metal ducts with liquid adhesive plus tape.
- H. Install duct test holes where required for testing and balancing purposes.
- I. Installation:
1. Install ducts fully extended.
  2. Do not bend ducts across sharp corners.
  3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
  4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
  5. Install flexible ducts in a direct line, without sags, twists, or turns.
- J. Supporting Flexible Ducts:
1. Suspend flexible ducts with bands 1 ½ inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
  2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
  3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
  4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c..

END OF SECTION

**SECTION 23 37 13.13 - AIR DIFFUSERS****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Round ceiling diffusers.
  - 2. Rectangular and square ceiling diffusers.
  - 3. Linear bar diffusers.
  - 4. Linear slot diffusers.
  - 5. Floor Diffusers
  - 6. Louvers
  - 7. Air Filters
- B. Related Requirements:
  - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
  - 2. Section 233713.43 "Security Registers and Grilles" for security registers and security grilles.
  - 3. The SMACNA Low Velocity Duct Manual, ASHRAE Handbooks, International Mechanical Code, and NFPA Pamphlet 90A shall apply to this work.
  - 4. Refer to Section 233113 "Metal Ductwork."

**1.02 WORK INCLUDED**

- A. Provide labor, material, equipment, and supervision necessary to install a complete air handling system with all supply and return distribution devices as indicated on the drawings and specified herein.
- B. Contractor is to furnish and install a volume damper in all supply, return, exhaust, and outside air branch ductwork. If these are omitted from the drawings, the contractor is to make an allowance to install one.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Submit manufacturer's literature and performance data of equipment and devices for review.
- C. Samples; Furnish at request of A/E.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with manufacturer's warranty requirements.
- B. Provide adequate supervision of labor force to see that installations are correct.

**PART 2 - PRODUCTS**

**2.01 RECTANGULAR AND SQUARE CEILING DIFFUSERS**

- A. Furnish and install terminal air diffusers of the size and capacity indicated on the drawings.
- B. Room terminal air velocity shall not exceed 50 fpm. NC level shall not exceed 40. Air static pressure drop shall not exceed 0.10" wg.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Anemostat
  - 2. Carnes Company.
  - 3. Hart & Cooley Inc.
  - 4. Krueger.
  - 5. METALAIRE, Inc.
  - 6. Nailor Industries Inc.
  - 7. Price Industries.
  - 8. Titus.
  - 9. Tuttle & Bailey.
- D. Devices shall be specifically designed for variable-air-volume flows.
- E. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
- F. Finish: Baked enamel, white
- G. Face Size: 12 by 12 inches for up to 150 cfm, 24 by 24 inches for all other size.
- H. Face Style: Plaque.
- I. Mounting: Each diffuser shall have a mounting flange specifically selected for the particular type of ceiling finish. Contractor to coordinate with architectural ceiling details.
- J. Pattern: Fixed
- K. Dampers: Radial opposed blade
- L. Accessories:
  - 1. Equalizing grid.
  - 2. Plaster ring.
- M. Performance shall be tested in accordance with ASHRAE 70-2006 (RA 2011).

**2.02 LINEAR BAR DIFFUSERS**

- A. Furnish and install linear type air diffusers of the lengths and capacities indicated on the drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Anemostat Products; a Mestek company.
  - 2. Carnes Company.
  - 3. Krueger.
  - 4. METALAIRE, Inc.
  - 5. Nailor Industries Inc.
  - 6. Price Industries.
  - 7. Titus.
  - 8. Tuttle & Bailey.
- C. Devices shall be specifically designed for variable-air-volume flows.
- D. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
- E. Finish: Baked enamel, white
- F. Wide Core Spacing Arrangement: 1/8-inch- thick blades spaced 1/2 inch apart; zero-degree deflection. Pencil-Proof Core Spacing Arrangement: 3/16-inch- thick blades spaced 7/16

- inch apart; zero deflection.
- G. One or Two-Way Deflection Vanes: Extruded construction adjustable louvers with removable core.
- H. Frame: 1 inch wide.
- I. Mounting Frame: Each diffuser shall have a mounting flange specifically selected for the particular type of ceiling finish. Contractor to coordinate with architectural ceiling details.
- J. Mounting: Countersunk screw.
- K. Damper Type: Adjustable opposed-blade assembly
- L. Accessories: Plaster frame for drywall or plaster ceilings

## 2.03 LINEAR SLOT DIFFUSERS

- A. Furnish and install linear type air diffusers of the lengths and capacities indicated on the drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Anemostat Products; a Mestek company.
  - 2. Carnes Company.
  - 3. Hart & Cooley Inc.
  - 4. Krueger.
  - 5. METALAIRE, Inc.
  - 6. Nailor Industries Inc.
  - 7. Price Industries.
  - 8. Titus.
  - 9. Tuttle & Bailey.
- C. Devices shall be specifically designed for variable-air-volume flows.
- D. Material - Shell: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
- E. Material - Pattern Controller and Tees: Aluminum.
- F. Finish - Face and Shell: Baked enamel, black.
- G. Finish - Pattern Controller: Baked enamel, black.
- H. Finish - Tees: Baked enamel, white.
- I. Slot Width: 1 inch
- J. Number of Slots: One, Two, Three or Four
- K. Length: As noted in the Air Device Schedule
- L. Accessories: Plaster frame for drywall or plaster ceilings

## 2.04 LOUVERS

- A. Louvers shall be extruded aluminum with 12-gauge blades and frames 2" deep up to 12" in height. 4" deep from 12" to 36" in height, and 6" deep above 36" in height. Louvers shall be storm proof design and shall not pull rain through the blades at the capacity required by the system.
- B. Furnish a bird screen on each louver mounted at the inside face.
- C. Frames shall be miter welded with reinforced corners.
- D. Louver finish shall be determined by the architect. Contractor to coordinate.
- E. Manufacturer: American Warming and Ventilating, Ruskin, Greenheck and Pottorff, United Enertech.

## 2.05 AIR FILTERS

- A. Refer to drawings and schedules for certain air filtration requirements for various systems.
- B. These filters are to be installed in air handling equipment if the equipment is capable of receiving them. If not, the contractor shall install the filters in a filter frame with gasketed doors on the entering side of the unit. The filter frame in either case shall provide an airtight fit with gaskets.
- C. Furnish and install a red oil manometer for each filter of efficiency of 30 percent or more and with a range of 0 to 30 inches water gage. Gauge to be Dwyer Instruments, Inc.
- D. The filter shall meet a minimum of MERV (xx) @ 2000 cfm (500 fpm) per ASHRAE Standard 52.2-2007 and shall be required to meet the same MERV-A value when tested per "Appendix j" of the aforementioned Standard. A filter with a MERV -A value lower than the MERV rating is not acceptable.
- E. Manufacturers: CAMFIL/FARR Co., ECO Air Filters, Flanders, American Air Filter.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install diffusers level and plumb.
- B. Supports: Galvanized steel per SMACNA.
- C. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

#### **3.02 ADJUSTING**

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

#### **3.03 LOUVERS**

- A. Louvers shall be set plumb in wall openings left by general contractor.
- B. Coordinate openings with G. C.
- C. Louvers shall be anchored in masonry construction.
- D. Frames shall be caulked watertight. Color of caulking shall be acceptable to the architect.
- E. Connections to wall louvers shall be sloped down to louver connection to prevent water draining into interior.

#### **3.04 FILTERS**

- A. All filters shall be clean prior to acceptance by the owner. Renewable media filters shall be replaced with new filters. Cleanable filters shall be removed and cleaned just prior to acceptance.
- B. Provide one spare set of replaceable filters for each system to the owner prior to acceptance

of the work.

END OF SECTION

**SECTION 23 37 13.23 - REGISTERS AND GRILLES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Adjustable blade face registers and grilles.
  - 2. Fixed face registers and grilles.
- B. Related Requirements:
  - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
  - 2. Section 233713.13 "Air Diffusers" for various types of air diffusers.
  - 3. Section 233713.43 "Security Registers and Grilles" for security registers and security grilles.
  - 4. The SMACNA Low Velocity Duct Manual, ASHRAE Handbooks, International Mechanical Code, and NFPA Pamphlet 90A shall apply to this work.
  - 5. Refer to Section 233113 "Metal Ductwork".

**1.02 WORK INCLUDED**

- A. Provide labor, material, equipment, and supervision necessary to install a complete air handling system with all supply and return distribution devices as indicated on the drawings and specified herein.
- B. Contractor is to furnish and install a volume damper in all supply, return, exhaust, and outside air branch ductwork. If these are omitted from the drawings, the contractor is to make an allowance to install one.

**1.03 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Submit manufacturer's literature and performance data of equipment and devices for review.
- C. Samples; Furnish at request of A/E.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with manufacturer's warranty requirements.
- B. Provide adequate supervision of labor force to see that installations are correct.

**PART 2 - PRODUCTS****2.01 GRILLES**

- A. Furnish and install terminal air registers of the size and capacities indicated on the drawings.
- B. Adjustable Blade Face Grille:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of



the following:

- a. Anemostat Products; a Mestek company.
  - b. Carnes Company.
  - c. Krueger.
  - d. METALAIRE, Inc.
  - e. Nailor Industries Inc.
  - f. Price Industries.
  - g. Titus.
  - h. Tuttle & Bailey.
2. Material: Steel. Shall be aluminum if located in a damp area similar to a commercial kitchen, locker room, residential bathrooms.
  3. Finish: Baked enamel, white.
  4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
  5. Core Construction: Removable.
  6. Rear-Blade Arrangement: Horizontal, spaced 1/2 inch centers for return and exhaust and 3/4 inch centers for supply, single set at 45 degrees for return or exhaust and double deflection adjustable for supply. Reinforced corners, mitered.
  7. Frame: 1 inch.
  8. Mounting Frame: Provide separable frames in drywall, plaster, or masonry construction as noted on the architectural drawings.
  9. Mounting: Countersunk screw.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Install registers and grilles level and plumb.
- B. Supports: Galvanized steel per SMACNA.
- C. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

#### **3.02 ADJUSTING**

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

END OF SECTION

**SECTION 23 37 13.43 - SECURITY REGISTERS AND GRILLES****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes security registers and grilles for detention area.

**1.02 REFERENCE**

- A. Refer to Section 23 05 00 for requirements which are applicable to this section.
- B. The SMACNA Low Velocity Duct Manual, ASHRAE Handbooks, IBC Mechanical Code, and NFPA Pamphlet 90A shall apply to this work.

**1.03 WORK INCLUDED**

- A. Provide labor, material, equipment, and supervision necessary to install a complete air handling system as indicated on the drawings and specified herein.
- B. Contractor is to furnish and install volume dampers in all supply, return, exhaust, and outside air branch ductwork. If these are omitted from the drawings, the contractor is to make an allowance to install one.

**1.04 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Submit shop drawings of all devices for review.
- C. Submit manufacturer's literature and performance data of equipment and devices for review.
- D. Samples; Furnish at request of A/E.

**1.05 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale.

**PART 2 - PRODUCTS****2.01 SECURITY REGISTERS****SECURITY GRILLES, REGISTERS & DIFFUSERS**

- A. Security Type 2 (ST2) Medium/Minimum Security Grilles and Registers
  1. Steel construction, fixed bars, 45 degrees deflection.
  2. Frame: Constructed of 16-gauge steel frame with mitered corners, reinforced with corner welding.
  3. Louvers: 1/8" steel bar on 1/2" center spacing passing through the sleeve. Both ends are wire welded. Louvers' strength is fortified by interconnecting louvers with support rods on 6" centers.

4. Sleeve is 14 gauge steel sleeve welded to the frame. The length of the sleeve will be determined as required.
  5. Steel screen: 10-gauge 3/8" wire mesh in back of louvers is secured by 16-gauge steel angle welded in place.
  6. Entirely welded construction.
  7. White baked enamel.
  8. Option: 1" x 1" x 3/16" steel angels shipped loose or attached.
  9. Option: Opposed blade damper operated at the rear. (Register).
  10. 1/2" diameter security bars.
  11. Nailor Industries, Model Series: SG-BM4.
- B. Security Type 3 (ST3) Medium/Minimum Security Grilles and Registers
1. Steel construction, fixed bars, 0 degrees deflection.
  2. Frame: Constructed of 16-gauge steel frame with mitered corners, reinforced with corner welding.
  3. Louvers: 1/8" steel bar on 1/2" center spacing passing through the sleeve. Both ends are wire welded. Louvers' strength is fortified by interconnecting louvers with support rods on 6" centers.
  4. Sleeve is 14-gauge steel sleeve welded to the frame. The length of the sleeve will be determined as required.
  5. Steel screen: 10-gauge 3/8" wire mesh in back of louvers is secured by 16-gauge steel angle welded in place.
  6. Entirely welded construction.
  7. White baked enamel.
  8. Option: 1" x 1" x 3/16" steel angels shipped loose or attached.
  9. Option: Opposed blade damper operated at the rear. (Register).
  10. 1/2" diameter security bars.
  11. Nailor Industries, Model Series: SG-BMZ.
  12. rs available.
  13. Nailor Industries, Model Series: SG-PR.
- C. Security Type 6 (ST6) Minimum Security Diffusers
1. Steel louvered core, steel latticed face, 1, 2, 3 or 4-way deflection.
  2. Face plate is constructed of 12-gauge steel with 13/16" square holes and 3/16" bars.
  3. Furnished with face plate with countersunk screw holes. Tamper-proof screws, if required, should be provided by others.
  4. Finish: White baked enamel.
  5. Opposed blade damper.
  6. Nailor Industries, Model Series: SG-6500.

## 2.02 SECURITY GRILLES MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Anemostat Products; a Mestek company.
  2. Carnes Company.
  3. Krueger.
  4. Nailor Industries Inc.
  5. Price Industries.
  6. Titus.
  7. Tuttle & Bailey.

**PART 3 - EXECUTION****3.01 INSTALLATION**

- A. Install registers and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Install in accordance with manufacturers' instructions.
- E. Secure with security fasteners or concealed fasteners.
- F. Installation shall maintain the full level of security provided by the device. The connection to ductwork and installation shall be secure.

**3.02 CEILING OPENING PROTECTION**

- A. Each supply, return, and exhaust opening in a ceiling shall be protected in accordance with UL Laboratories for the integrity of the fire stopping rating. This will require that each opening be suitably protected throughout the building.
- B. Dampers shall bear the U.L. Label and shall be installed in accordance with the U.L. Standards and manufacturer's instructions.
- C. A ceramic blanket shall be attached to diffuser neck and duct using steel duct clamp or 16 ga. steel wire. Blanket shall be supported from 4 corners using 12 swg wire.

**3.03 ADJUSTING**

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

END OF SECTION

**SECTION 23 74 16.12 - PACKAGED, SMALL-CAPACITY, HEAT PUMP FIRED ROOFTOP UNITS (3-10 TONS)****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes packaged, small-capacity, rooftop air-conditioning units (RTUs) with the following components and accessories:
  - 1. Casings.
  - 2. Fans.
  - 3. Motors.
  - 4. Coils.
  - 5. Refrigerant circuit components.
  - 6. Air filtration.
  - 7. Dampers.
  - 8. Electrical power connections.
  - 9. Controls.
  - 10. Accessories.
  - 11. Roof curbs.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each RTU.
- B. Sustainable Design Submittals:
  - 1. Product Data: For air filtration performance.
  - 2. Product Data: For ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings:
  - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Include diagrams for power, signal, and control wiring.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Field quality-control reports.
- C. Sample warranty.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**1.05 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in

materials or workmanship within specified warranty period.

1. Warranty Period for Parts: One year from start-up.
2. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for UVGI System: Lifetime with exception of lamps.

## **PART 2 - PRODUCTS**

### **2.01 DESCRIPTION**

- A. AHRI Compliance:
  1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs for 3 to 5 ton units.
  2. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs for 6 to 10 ton units.
  3. Comply with AHRI 270 for testing and rating sound performance for RTUs.
- B. AMCA Compliance:
  1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
  2. Damper leakage tested according to AMCA 500-D.
  3. Operating Limits: Classify according to AMCA 99.
- C. ASHRAE Compliance:
  1. Comply with ASHRAE 15 for refrigeration system safety.
  2. Comply with ASHRAE 33 for methods of testing cooling coils.
  3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES Compliance: Comply with applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.
- F. UL Compliance: Comply with UL 1995.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### **2.02 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Lennox Industries, Inc.; Lennox International.

### **2.03 CAPACITIES AND CHARACTERISTICS**

- A. Refer to drawings for performance requirements.

### **2.04 CASINGS**

- A. General Fabrication Requirements for Casings: Fabricated to allow removal for access to

- internal parts and components, with joints between sections sealed.
- B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
    - 1. Corrosion Protection: 1,000 hours' salt spray test according to ASTM B 117.
  - C. Plastic Condensate Drain Pans: Fabricated using rigid heavy plastic polymer, a minimum of 2 inches deep, and complying with ASHRAE 62.1 for design and construction of drain pans.
  - D. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  - E. Units shall be convertible airflow design as manufactured. Hot gas
  - F. Cabinet construction shall allow for all service / maintenance from one side of the unit.

## 2.05 FANS

- A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
  - 1. Direct-Driven Supply-Air Fans: Motor shall be resiliently mounted in the fan inlet.
  - 2. Belt-Driven Supply-Air Fans: Motors shall be installed on an adjustable fan base resiliently mounted in the casing.
- B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated motors.

## 2.06 MOTORS

- A. Comply with NEMA MG 1, Design B, medium induction motor, unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.
- C. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- D. Duty: Continuous duty at ambient temperature of 104 deg. F and at altitude of 3300 feet above sea level.
- E. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- F. Efficiency: Energy efficient, as defined in NEMA MG 1.
- G. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements.
- H. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- I. Multispeed Motors: Separate winding for each speed.
- J. Rotor: Random-wound, squirrel cage.
- K. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- L. Temperature Rise: Match insulation rating.
- M. Insulation: Class F.
- N. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- O. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.
- P. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal

box, suited to control method.

- Q. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short-time rise pulses produced by pulse-width-modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
5. Service Factor: 1.15.
6. Efficiency: Premium efficient.

## 2.07 COILS

- A. Supply-Air Refrigerant Coil:

1. Aluminum plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Polymer strip shall prevent all copper coils from contacting steel coil frame or condensate pan.
3. Coil Split: Interlaced.
4. Coated.

## 2.08 REFRIGERANT CIRCUIT COMPONENTS

- A. Compressor: Hermetic, variable-speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
- B. Refrigeration Specialties:
1. Refrigerant: R-410A.
  2. Expansion valve with replaceable thermostatic element.
  3. Refrigerant filter/dryer.
  4. Manual-reset high-pressure safety switch.
  5. Automatic-reset low-pressure safety switch.
  6. Minimum off-time relay.
  7. Automatic-reset compressor motor thermal overload.
  8. Brass service valves installed in compressor suction and liquid lines.
- C. Provide reversing valve, discharge muffler, flow control check valve, and electronic adaptive demand defrost control on all units.
- D. Units shall have cooling capabilities down to 0 degree F as standard.
- E. Provide Dual Circuit refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction, and liquid line pressure ports on units greater than 5 tons cooling capacity.

## 2.09 AIR FILTRATION

- A. Minimum arrestance and MERV according to ASHRAE 52.2 2007 and shall be required to meet the same MERV-11 value when tested per "Appendix j" of the aforementioned Standard. A filter with a MERV -11 value lower than the MERV rating is not acceptable.

## 2.10 DAMPERS



- A. Leakage Rate: Comply with ASHRAE/IES 90.1.
- B. Damper Motor: Modulating with adjustable minimum position.

## 2.11 ELECTRICAL POWER CONNECTIONS

- A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

## 2.12 CONTROLS

- A. Control equipment and sequence of operation are specified in Section 230933 "Automatic Temperature Control"
- B. Basic Unit Controls:
  - 1. Control-voltage transformer.
  - 2. Wall-mounted thermostat with the following features:
    - a. Heat-cool-off switch.
    - b. Fan on-auto switch.
    - c. Fan-speed switch.
    - d. Automatic changeover.
    - e. Adjustable deadband.
- C. Electronic Controller:
  - 1. Controller shall have volatile-memory backup.
  - 2. Safety Control Operation:
    - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire-alarm control panel.
    - b. Fire-Alarm Control Panel Interface: Provide control interface to the fire alarm system.
  - 3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of two programmable periods per day.
  - 4. Refer to the control specification section for the sequence of operation.

## 2.13 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.
- B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- C. Factory- or field-installed, demand-controlled ventilation.
- D. Safeties:
  - 1. Smoke detector shall be factory installed photoelectric smoke detector mounted in the return air section and/or supply air fan compartment.
  - 2. Condensate overflow switch.
  - 3. Phase-loss reversal protection.
  - 4. High- and low-pressure control.
  - 5. Electric coil airflow-proving switch.
- E. Hail guards of galvanized steel, painted to match casing.
- F. Door switches to disable heating or reset set point when open.
- G. Outdoor-air intake weather hood.
- H. On rooftop units larger than 4.5 tons cooling capacity, provide a fully integrated 100%

modulating outside air economizer with unit return and barometric relief air dampers, minimum position setting, preset linkage, wiring harness with plug. Unit operation is through primary temperature controls that automatically modulate dampers to maintain space temperature conditions. Economizer shall be dual enthalpy control.

- I. Economizer Power Exhaust – Factory supplied, field installed power exhaust assembly.
- J. Dehumidification / Hot Gas Reheat - Unit shall be equipped with internally finned, 5/16" copper tubes. The coil shall be 2 rows with a minimum of 16 fins per inch. Dehumidification shall be achieved by routing hot refrigerant gas from the discharge line of the compressor through the reheat coil.

## 2.14 ROOF CURBS

- A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
- B. Curb Dimensions: Height of 14 inches.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Roof Curb: Install on roof structure or concrete base, level and secure, according to the roofing manufacturers requirements. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in the architectural specifications. Secure RTUs to upper curb rail, and secure curb base to roof framing with anchor bolts.
- B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
- C. Any equipment mars, blemishes, scratches, abrasions, or other surface imperfections shall be sanded, primed, and refinished to match adjacent surfaces.
- D. No equipment will be accepted by the owner which has rust, corrosion, or otherwise in progress.
- E. Equipment shall not be used for temporary heat unless separately negotiated with the owner.
- F. All filters shall be new at time of acceptance by the owner.
- G. All bare ferrous metal shall be painted prior to acceptance.
- H. Equipment shall be in perfect working order prior to acceptance.
- I. Furnish and install all controls and control wiring. Wiring shall be in accordance with the NEC. Control wiring above the roof shall be in galvanized steel conduit with watertight fittings.

### 3.02 CONNECTIONS

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination at top of roof curb.
  - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
  - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section

## 233300 "Air Duct Accessories."

- 4. Install return-air duct continuously through roof structure.
- B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- C. Where installing piping adjacent to RTUs, allow space for service and maintenance.

## 3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Tests and Inspections:
  - 2. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
  - 3. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. RTU will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## 3.04 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

## 3.05 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION

**SECTION 23 74 16.14 - PACKAGED, MID-CAPACITY, HEAT PUMP ROOFTOP UNITS  
(12.5 TO 25 TONS)****PART 1 - GENERAL****1.01 SUMMARY**

- A. Section includes packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components and accessories:
  - 1. Casings.
  - 2. Fans.
  - 3. Motors.
  - 4. Coils.
  - 5. Refrigerant circuit components.
  - 6. Air filtration.
  - 7. Supported bag filters.
  - 8. Dampers.
  - 9. Electrical power connections.
  - 10. Controls.
  - 11. Accessories
  - 12. Roof curbs.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
  - 2. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.
  - 3. Product Data: For energy performance.
  - 4. Product Data: For ventilation equipment, indicating compliance with ASHRAE 62.1, Section 5 - "Systems and Equipment."
  - 5. Product Data: For air filtration performance.
- C. Shop Drawings:
  - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Include diagrams for power, signal, and control wiring.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Field quality-control reports.
- D. Sample warranty.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

#### 1.05 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
  - 2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.
  - 3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
  - 4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
  - 5. Warranty Period for UVGI System: Lifetime with exception of lamps.

## PART 2 - PRODUCTS

#### 2.01 SYSTEM DESCRIPTION

- A. AHRI Compliance:
  - 1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
  - 2. Comply with AHRI 270 / 370 for testing and rating sound performance for RTUs.
  - 3. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
- B. AMCA Compliance:
  - 1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
  - 2. Damper leakage tested in accordance with AMCA 500-D.
  - 3. Operating Limits: Classify according to AMCA 99.
- C. ASHRAE Compliance:
  - 1. Comply with ASHRAE 15 for refrigeration system safety.
  - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
  - 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.
- F. UL Compliance: Comply with UL 1995.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Lennox Industries, Inc.; Lennox International.

#### 2.03 CAPACITIES AND CHARACTERISTICS

- A. Refer to drawings for performance requirements.

## 2.04 CASINGS

- A. General Fabrication Requirements for Casings: Formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Single Wall Construction.
- C. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
  - 1. Corrosion Protection: 1,000 hours salt spray test in accordance with ASTM B117.
- D. Inner Casing Fabrication Requirements:
  - 1. Inside Casing: G-90-coated galvanized steel, 0.028 inch thick.
- E. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
  - 1. Materials: ASTM C 1071, Type I.
  - 2. Thickness: 1/2 inch.
  - 3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
  - 4. Liner Adhesive: Comply with ASTM C 916, Type I.
- F. Condensate Drain Pans: Fabricated using stainless steel, a minimum of 2 inches deep, and complying with ASHRAE 62.1 for design and construction of drain pans.
  - 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
  - 2. Drain Connections: Threaded nipple.
- G. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

## 2.05 FANS

- A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
  - 1. Forward curved, double width, double inlet, centrifugal type fan.
  - 2. Belt-Driven Supply-Air Fans: Motors shall be installed on an adjustable fan base resiliently mounted in the casing.
- B. Condenser-Coil Fan: Direct drive propeller, mounted on shaft of permanently lubricated motors.

## 2.06 MOTORS

- A. Comply with NEMA MG 1, Design B, medium induction motor, unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.
- C. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- D. Duty: Continuous duty at ambient temperature of 104 deg. F and at altitude of 3300 feet above sea level.
- E. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- F. Efficiency: Energy efficient, as defined in NEMA MG 1.
- G. Comply with NEMA designation, temperature rating, service factor, and efficiency

- requirements.
- H. Multispeed Motors: Variable torque.
    - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
    - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
  - I. Multispeed Motors: Separate winding for each speed.
  - J. Rotor: Random-wound, squirrel cage.
  - K. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
  - L. Temperature Rise: Match insulation rating.
  - M. Insulation: Class F.
  - N. Code Letter Designation:
    - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
    - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
  - O. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.
  - P. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

## 2.07 COILS

- A. Supply-Air Refrigerant Coil:
  - 1. Aluminum-plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
  - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
  - 3. Coil Split: Interlaced.
  - 4. Condensate Drain Pan: Galvanized steel with corrosion-resistant coating formed with pitch and drain connections.
- B. Outdoor-Air Refrigerant Coil:
  - 1. Aluminum plate fin and seamless internally grooved copper tube in steel casing with equalizing-type vertical distributor.
  - 2. Polymer strip shall prevent all copper coil from contacting steel coil frame or condensate pan.
- C. Electric-Resistance Heating:
  - 1. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
  - 2. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
  - 3. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
  - 4. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
    - a. Magnetic contactors.
    - b. Step Controller: Pilot lights and override toggle switch for each step.
    - c. Time-delay relay.
    - d. Airflow proving switch.

## 2.08 REFRIGERANT CIRCUIT COMPONENTS

- A. Number of Refrigerant Circuits: Two.
- B. Compressor: Hermetic, direct drive scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
- C. Refrigeration Specialties:
  - 1. Refrigerant: R-410A.
  - 2. Expansion valve with replaceable thermostatic element.
  - 3. Refrigerant filter/dryer.
  - 4. Manual-reset high-pressure safety switch.
  - 5. Automatic-reset low-pressure safety switch.
  - 6. Minimum off-time relay.
  - 7. Automatic-reset compressor motor thermal overload.
  - 8. Brass service valves installed in compressor suction and liquid lines.
- D. Provide reversing valve, discharge muffler, flow control check valve, and electronic adaptive demand defrost control on all units.
- E. Units shall have cooling capabilities down to 0-degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
- F. Variable Speed Compressors (12.5-17.5 tons only)
  - 1. Variable speed compressor shall be capable of speed modulation from 15Hz to a maximum of 75Hz. The minimum unit capacity shall be 25% of full load or less. The compressor motor shall be permanent magnet type. Each variable speed compressor shall be matched with a specifically designed, refrigerant cooled, variable frequency drive which modulates the speed of the compressor motor and provides several compressor protection functions. Control of the variable speed compressor and inverter control, as well as tandem direct driver, scroll type compressors shall be integrated with the controller to ensure optimal equipment reliability and efficiency. Each compressor shall have a crankcase heater as standard.

## 2.09 AIR FILTRATION

- A. Minimum arrestance and MERV according to ASHRAE 52.2 2007 and shall be required to meet the same MERV-A value when tested per "Appendix j" of the aforementioned Standard. A filter with a MERV -A value lower than the MERV rating is not acceptable.

## 2.10 DAMPERS

- A. Outdoor- and Return-Air Mixing Dampers: Opposed blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage or gears and interconnect so dampers operate simultaneously.
  - 1. Leakage Rate: As required by ASHRAE/IES 90.1.
  - 2. Damper Motor: Modulating with adjustable minimum position.
  - 3. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IES 90.1, with bird screen and hood.

## 2.11 ELECTRICAL POWER CONNECTIONS

- A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.



## 2.12 CONTROLS

- A. Control equipment and sequence of operation are specified in Section 230933 " Automatic Temperature Control"

Basic Unit Controls:

1. Control-voltage transformer.
2. Wall-mounted thermostat or sensor with the following features:
  - a. Heat-cool-off switch.
  - b. Fan on-auto switch.
  - c. Fan-speed switch.
  - d. Automatic changeover.
  - e. Adjustable deadband.

- B. Electronic Controller:

1. Controller shall have volatile-memory backup.
2. Safety Control Operation:
  - a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire-alarm control panel.
  - b. Fire-Alarm Control Panel Interface: Provide control interface to the fire alarm system.
3. Scheduled Operation: Occupied and unoccupied periods on 365-day clock with a minimum of two programmable periods per day.
4. Refer to the control specification section for the sequence of operation.

## 2.13 ACCESSORIES

- A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.
- B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
- C. Field-installed, demand-controlled ventilation.
- D. Safeties:
  1. Smoke detector - Smoke detector shall be factory installed photoelectric smoke detector mounted in the return air section and/or supply air fan compartment.
  2. Condensate overflow switch.
  3. Phase-loss reversal protection.
  4. High- and low-pressure control.
  5. Electric coil airflow-proving switch.
- E. Hail guards of galvanized steel, painted to match casing.
- F. Door switches to disable heating or reset set point when open.
- G. Outdoor-air intake weather hood.
- H. Provide a fully integrated 100% modulating outside air economizer with unit return and barometric relief air dampers, minimum position setting, preset linkage, wiring harness with plug. Unit operation is through primary temperature controls that automatically modulate dampers to maintain space temperature conditions. Economizer shall be dual enthalpy control.
- I. Economizer Power Exhaust – Factory supplied, field installed power exhaust assembly.
- J. Dehumidification / Hot Gas Reheat - Unit shall be equipped with internally finned, 5/16" copper tubes. The coil shall be 2 rows with a minimum of 16 fins per inch. Dehumidification shall be achieved by routing hot refrigerant gas from the discharge line of the compressor

- through the reheat coil.
- K. Single Zone VAV
    - 1. Unit shall be provided with VFD (Variable Frequency Drive) on Indoor fan motor. VFD shall change fan speed according to mode of operation. During cooling mode, fan shall modulate to maintain space temperature. the compressor shall operate to control discharge air temperature. This operation shall be standard with SZVAV offering. During heating operation, single zone control will be allowed with modulating gas heat only. All other heat operations shall be as constant volume heating control.
    - 2. Unit shall be provided with optional shaft grounding rings for electrical protection. Shaft grounding rings provide long term motor/VFD bearing reliability.
  - L. DELIVERED VAV
    - 1. Unit shall be provided with VFD (Variable Frequency Drive) on Indoor fan motor. VFD shall change fan speed according to mode of operation. The VFD shall receive a 0-10 Vdc signal from the unit controls based upon supply static pressure and shall cause the drive to accelerate or decelerate as required to maintain the supply static pressure setpoint. When subjected to high ambient return conditions the VFD shall reduce its output frequency to maintain operation.
    - 2. Unit shall be provided with shaft grounding rings for electrical protection. Shaft grounding rings provide long term motor/VFD bearing reliability.

#### 2.14 ROOF CURBS

- A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
- C. Curb Dimensions: Height of 14 inches 24 inches 36 inches.
- D. Hot gas re-heat units require horizontal discharge roof curbs 36" / 48" in height in units 12.5 to 25 tons.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Roof Curb: Install on roof structure, level and secure, according to the roofing manufacturers requirements. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in the architectural specifications. Secure RTUs to upper curb rail, and secure curb base to roof framing with anchor bolts.
- B. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.
- C. Any equipment mars, blemishes, scratches, abrasions, or other surface imperfections shall be sanded, primed, and refinished to match adjacent surfaces.
- D. No equipment will be accepted by the owner which has rust, corrosion, or otherwise in progress.
- E. Equipment shall not be used for temporary heat unless separately negotiated with the owner.
- F. All filters shall be new at time of acceptance by the owner.
- G. All bare ferrous metal shall be painted prior to acceptance.
- H. Equipment shall be in perfect working order prior to acceptance.
- I. Furnish and install all controls and control wiring. Wiring shall be in accordance with the

NEC. Control wiring above the roof shall be in galvanized steel conduit with watertight fittings.

### 3.02 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
  - 1. Install ducts to termination at top of roof curb.
  - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
  - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
  - 4. Install return-air duct continuously through roof structure.

### 3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
  - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. RTU will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.04 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION

**SECTION 23 81 20 – VARIABLE REFRIGERANT SYSTEMS (TRANE/MITSUBISHI)****PART 1 - GENERAL****1.01 SYSTEM DESCRIPTION R2-SERIES (SIMULTANEOUS HEAT/COOL)**

Per the equipment schedule, the variable capacity, heat pump heat recovery air conditioning system basis of design is Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system(s). Acceptable alternative manufacturers, assuming compliance with these equipment specifications, are Daikin, Panasonic, and Hitachi. Contractor bidding an alternate manufacturer does so with full knowledge that that manufactures product may not be acceptable or approved and that contractor is responsible for all specified items and intents of this document without further compensation.

Simultaneous heating/cooling (heat recovery) systems shall consist of an outdoor unit, BC (Branch Circuit) Controller (or comparable branch devices), multiple indoor units, and an integral DDC (Direct Digital Controls) system. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes.

No additional branch circuit controllers (or comparable branch devices) than shown on the drawings/schedule may be connected to any one outdoor unit.

Contractors proposing alternate systems requiring more branch devices than those included as the basis of design are responsible for additional piping & electrical costs and are required to identify additional costs & installation time required of other trades with their bid.

**1.02 QUALITY ASSURANCE**

1. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.
2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
3. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
4. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.
5. System start-up supervision shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in system configuration and operation. The representative shall provide proof of manufacturer certification indicating successful completion within no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals.

**1.03 DELIVERY, STORAGE, AND HANDLING**

1. Unit shall be stored and handled according to the manufacturer's recommendation.

**PART 2 - WARRANTY**

- A. The CITY MULTI units shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to the original owner from date of installation.
- B. Manufacturer shall have a minimum of fifteen (15) years continuous experience providing VRF systems in the U.S. market.  
All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required.  
Registering and sign-in requirements which may delay emergency service reference are not allowed.
- C. The CITY MULTI VRF system shall be installed by a contractor with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

**PART 3 - OUTDOOR UNITS****3.01 R2-SERIES HIGH EFFICIENCY (HEAT RECOVERY), AIR COOLED OUTDOOR UNITS****General:**

- A. The outdoor unit modules shall be air-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section and Part 5 (Controls). The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
- B. Outdoor unit systems may be comprised of multiple modules with differing capacity if a brand other than basis of design is proposed. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor. Contractor responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, etc.
- C. Outdoor unit shall have a sound rating no higher than 68 dB(A) individually or 70 dB(A) twinned. Units shall have a sound rating no higher than 52 dB(A) individually or 55 dB(A) twinned while in night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
- D. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual.
- E. The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.
- F. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.
- G. The outdoor unit shall have a high-pressure safety switch, over-current protection, crankcase heater and DC bus protection.
- H. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.

- I. The outdoor unit shall be capable of operating in heating mode down to -25F ambient temperatures or cooling mode down to 23F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.
- J. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors (which may fail) to engage oil return sequence are not allowed.
- K. Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23F.
- L. While in hot gas defrost the system shall slow the indoor unit fan speed down to maintain a high discharge air temperature, systems that keep fan running in same state shall not be allowed as they provide an uncomfortable draft to the indoor zone due to lower discharge air temperatures.
- M. In reverse defrost all refrigerant shall be bypassed in the main branch controller and shall not be sent out to the indoor units, systems that flow refrigerant through indoor units during reverse defrost shall not be allowed.
- N. The outdoor unit shall be provided with a manufacturer supplied 20-gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.
- O. Unit Cabinet:
  - 1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.
  - 2. The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.
  - 3. Panels on the outdoor unit shall be scratch free at system startup. If a scratch occurs the salt spray protection is compromised, and the panel should be replaced immediately.
- P. Fan:
  - 1. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan(s) only. Fans shall be factory set for operation at 0 in. WG. external static pressure, but capable of normal operation with a maximum of 0.32 in. WG. external static pressure via dipswitch.
  - 2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
  - 3. All fans shall be provided with a raised guard to prevent contact with moving parts.
- Q. Refrigerant and Refrigerant Piping:
  - 1. R410A refrigerant shall be required for systems.
  - 2. Polyolester (POE) oil—widely available and used in conventional domestic systems—shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.
  - 3. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and installed in accordance with manufacturer recommendations.
  - 4. All refrigerant piping must be insulated with ½" closed cell, CFC-free foam insulation

with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. R value of insulation must be at least 3.

5. Refrigerant line sizing shall be in accordance with manufacturer specifications. Future changes to indoor unit styles or sizes must be possible without resizing/replacing refrigerant piping to any other branch devices or indoor units.

R. Coil:

1. Outdoor Coil shall be constructed to provide equal airflow to all coil face surface are by means of a 4-sided coil
2. Outdoor Coil shall be elevated at least 12" from the base on the unit to protect coil from freezing and snow build up in cold climates. Manufacturers in which their coil extends to within a few inches from the bottom of their cabinet frame shall provide an additional 12" of height to their stand or support structure to provide equal protection from elements as Mitsubishi Electric basis of design. Any additional support costs, equipment fencing, and tie downs required to meet this additional height shall be responsibility of Mechanical Contractor to provide.
3. The outdoor heat exchanger shall be of zinc coated aluminum construction with turbulating flat tube construction. The coil fins shall have a factory applied corrosion resistant finish. Uncoated aluminum coils/fins are not allowed.
4. The coil shall be protected with an integral metal guard.
5. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
6. Unit shall have prewired plugs for optional panel heaters in order to prevent any residual ice buildup from defrost. Panel heaters are recommended for operating environments where the ambient temperature is expected to stay below -1F for 72 hours.
7. Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from Ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed to bid on project in markets where the outdoor unit will see temperatures below freezing.

S. Compressor:

1. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non-inverter-driven compressors, which may cause inrush current (demand charges) and require larger generators for temporary power shall not be allowed.
2. Each compressor shall be equipped with a multi-port discharge mechanism to eliminate over compression at part load. Manufacturer's that rely on a single compressor discharge port and provide no means of eliminating over compression and energy waste at part load shall not be allowed.
3. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. Energy-wasting "belly-band" type crankcase heaters are not allowed. Manufacturers that utilize belly-band crankcase heaters will be considered as alternate only.
4. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 15%.
5. The compressor shall be equipped with an internal thermal overload.
6. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations

specific to each system and module placement for this project.

7. Manufacturers that utilize a compressor sump oil sensor to equalize compressor oil volume within a single module shall not be allowed unless they actively shut down the system to protect from compressor failure.

T. Controls:

1. The unit shall be an integral part of the system & control network described in Part 5 (Controls) and react to heating/cooling demand as communicated from connected indoor units over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.
2. Each outdoor unit module shall have the capability of 4 levels of demand control based on external input.
3. Electrical:
4. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz per equipment schedule.
5. The outdoor unit shall be controlled by integral microprocessors.
6. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

### 3.02 BRANCH CIRCUIT (BC) CONTROLLERS AS REQUIRED FOR SIMULTANEOUS HEAT/COOL SYSTEMS

#### General

- A. BC (Branch Circuit) Controllers (or comparable branch devices) shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices which do not include controlled refrigerant subcooling risk bubbles in liquid supplied to indoor unit LEVs and are not allowed.
- B. BC Controllers (or comparable branch devices) shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995 ed 4.
- C. BC Unit Cabinet:
  1. The casing shall be fabricated of galvanized steel.
  2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
  3. The unit shall house two tube-in-tube heat exchangers.
- D. Refrigerant Piping (specifications in addition to those for outdoor unit):
  1. All refrigerant pipe connections shall be brazed.
  2. Future changes to indoor unit quantities or sizes served by BC Controller or comparable branch device must be possible with no piping changes except between the branch device and indoor unit(s) changing. Systems which might require future piping changes between branch device and outdoor unit—if changes to indoor unit quantities or sizes are made—are not considered equal and are not allowed.
- E. Refrigerant valves:
  1. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.
  2. Condensate Management:



3. BC Controller (or comparable branch device) must have integral resin drain pan or insulate refrigeration components with removable insulation that allows easy access for future service needs. Cabinets filled with solid foam insulation do not allow for future service and are not allowed.

F. Electrical:

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz).
2. The BC Controller shall be controlled by integral microprocessors
3. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

## **PART 4 - INDOOR UNITS**

### **4.01 4-WAY CEILING-RECESSED CASSETTE WITH GRILLE INDOOR UNIT**

General:

- A. The ceiling-recessed indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns for different ceiling heights. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in plenums in accordance with UL1995 ed 4.
- B. Unit Cabinet:
  1. The cabinet panel shall have provisions for a field installed filtered outside air intake.
  2. Branch ducting shall be allowed from cabinet.
  3. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.
  4. The grille vane angles shall be individually adjustable from a wired remote controller to customize the airflow pattern for the conditioned space.
- C. Fan:
  1. The indoor fan shall be an assembly with a statically and dynamically balanced turbo fan direct driven by a single motor with permanently lubricated bearings.
  2. The indoor unit shall include an AUTO fan setting capable of maximizing energy efficiency by adjusting the fan speed based on the difference between controller set-point and space temperature. The indoor fan shall be capable of five (5) speed settings, Low, Mid1, Mid2, High and Auto.
  3. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
  4. The indoor unit fan logic must include multiple setting that can be changed to provide optimum airflow based on ceiling height and number of outlets used.
  5. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution.
  6. The vanes shall have an Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space.
  7. Grille shall include a factory-installed "3D i-see" sensor, or equal, to work in conjunction with indoor unit control sequence to prevent unnecessary cooling or heating in unoccupied areas of the zone without decreasing comfort levels. Sensor must detect occupancy (not simply motion) and location of occupants by measuring

size & temperature of objects within a 39' detecting diameter (based on 8.8ft mounting height) with 1,856 or more measuring points.

D. Filter:

1. Return air shall be filtered by means of a long-life washable filter

E. Coil:

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
2. The coils shall be pressure tested at the factory.
3. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.
4. Electrical:
5. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
6. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz).

F. Controls:

1. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
2. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable dead band from set point.
3. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
4. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
5. A factory-installed drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

#### 4.02 VERTICAL/HORIZONTAL DUCTED (MULTI-POSITION AIR HANDLER)

General:

- A. The multi-position indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory. The unit shall be suitable for use in air handling spaces in accordance with Section 18.2 of UL 1995 4<sup>th</sup> Edition, be tested in accordance with ANSI/ASHRAE 193 and have less than 2% air leakage at maximum airflow setting.
- B. Unit Cabinet:
  1. The cabinet shall include a fixed bottom return, a fixed vertical discharge supply and be pre-painted, pre-insulated, 22-gauge galvanized steel.
  2. Fan:
  3. The indoor unit fan shall be an assembly with a single, statically and dynamically balanced direct drive fan with a high efficiency DC motor with permanently lubricated bearings.

4. The fan shall have 3-speeds with the capability to operate between 0.3-0.8 In.WG selectable.
- C. Filter:
  1. The unit shall have a 1" filter rack with a reusable filter.
- D. Coil:
  1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.
  2. The coils shall be pressure tested at the factory.
- E. Electrical:
  1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
  2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz).
- F. Optional Electric Heat Kit:
  1. The indoor unit shall have a manufacturer supplied electric heat kit accessory. The electric heat kit shall offer either one or two stages of back up heat for maximum efficiency. The heater shall be designed to work with the indoor unit without any modifications to the unit or to the control sequence.
- G. Controls:
  1. Control board shall include contacts for control of no less than two stages of external heat. The first stage of external heat may be energized when the space temperature is 2.7°F from set point for between 10-25 minutes (user adjustable). The second stage of external heat may be energized when the first stage has been active for no less than 5 minutes and the space temperature has not risen by more than 0.9°F.
  2. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
  3. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

## **PART 5- CONTROLS**

### **5.01 OVERVIEW**

- A. The control system shall consist of a low voltage communication network and a web-based interface. The controls system shall gather data and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.
- B. Furnish energy conservation features such as optimal start, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.
- C. System shall be capable of email generation for remote alarm annunciation.

### **5.02 ELECTRICAL CHARACTERISTICS**

#### **General:**

- A. Controller power and communications shall be via a common non-polar communications bus and shall operate at 30VDC.
- B. Wiring:
  1. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit.

Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.

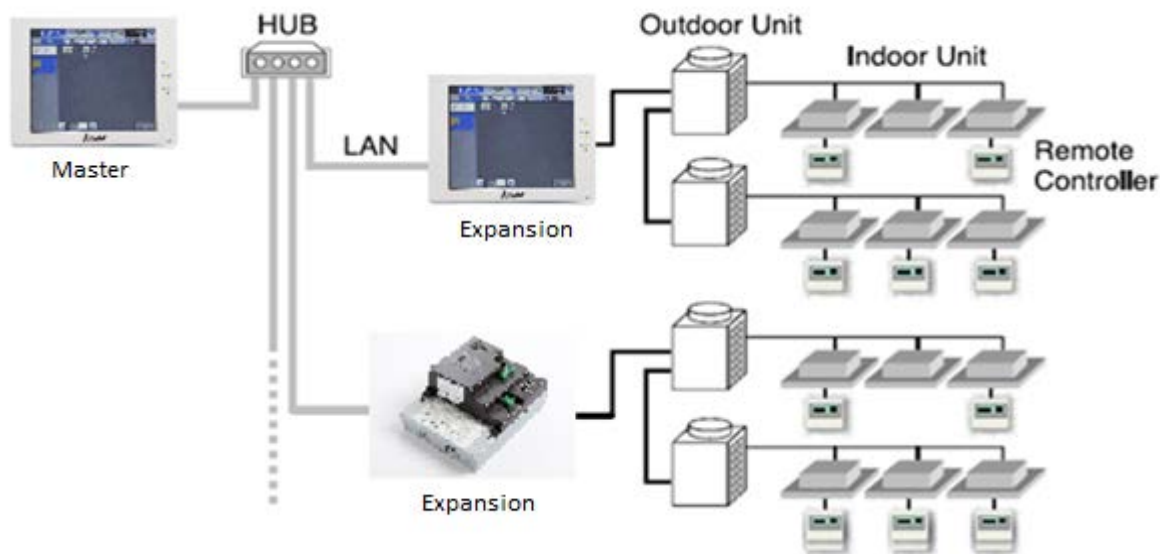
2. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web-based interface), to the power supply.

C. Wiring type:

1. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.
2. Network wiring shall be CAT-5 with RJ-45 connection.

### 5.03 CITY MULTI CONTROLS NETWORK

- A. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web-based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces. The below figure illustrates a sample CMCN System Configuration.



**CMCN System Configuration**

### 5.04 CMCN: REMOTE CONTROLLERS

A. Simple MA Remote Controller:

1. The Backlit Simple MA Remote Controller shall be capable of controlling up to 16 indoor units (defined as 1 group).
2. The Backlit Simple MA Remote Controller shall only be used in same group with Wireless MA Remote Controllers or with other Backlit Simple MA Remote Controllers, with up to two remote controllers per group.

<b>Simple MA Remote Controller</b>			
<b>Item</b>	<b>Description</b>	<b>Operation</b>	<b>Display</b>
ON/OFF	Run and stop operation for a single group	Each Group	Each Group
Operation Mode	Switches between Cool/Drying/Auto/Fan/Heat/Setback. Operation modes vary depending on the air conditioner unit. Auto and Setback mode are available for the R2/WR2-Series only.	Each Group	Each Group
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit.  Separate COOL and HEAT mode set points available depending on central controller and connected mechanical equipment.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Group	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions.	N/A	Each Group *1
Display Indoor Unit Intake Temp	Measures and displays the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Display Backlight	Pressing the button lights up a backlight. The light automatically turns off after a certain period of time. (The brightness settings can be selected from Bright, Dark, and Light off.)	N/A	Each Unit
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed	N/A	Each Unit
Test Run	Operates air conditioner units in test run mode. *2 The display for test run mode will be the same as for normal start/stop (does not display “test run”).	Each Group	Each Group *2
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit.	Each Group	N/A
Set Temperature Range Limit	Set temperature range limit for cooling, heating, or auto mode.	Each Group	Each Group

**B. Wired MA Remote Controller:**

1. The Backlit Wired MA Remote Controller shall be capable of controlling up to 16 indoor units (defined as 1 group).
2. The Backlit Wired MA Remote Controller shall only be used in same group with Wireless MA Remote Controllers or with other Backlit Wired MA Remote Controllers, with up to two remote controllers per group.

Item	Description	Operation	Display
ON/OFF	Run and stop operation for a single group	Each Group	Each Group
Operation Mode	Switches between Cool/Drying/Auto/Fan/Heat. Operation modes vary depending on the air conditioner unit. Auto mode is available for the R2/WR2-Series only.	Each Group	Each Group
Temperature Setting	Sets the temperature from 67°F – 87°F depending on operation mode and indoor unit.  Separate COOL and HEAT mode set points available depending on central controller and connected mechanical equipment.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Group	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote-control function (Start/Stop, Change operation mode, Set temperature, Vane, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions.	N/A	Each Group *1
Display Indoor Unit Intake Temp	Measures and displays the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Display Backlight	Pressing a button lights up a backlight. The light automatically turns off after a certain period of time. (The brightness settings can be selected from Bright, Dark, and Light off.)	N/A	Each Unit
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed	N/A	Each Unit
Test Run	Operates air conditioner units in test run mode. *2 The display for test run mode will be the same as for normal start/stop (does not display “test run”).	Each Group	Each Group *2
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit.	Each Group	N/A
Set Temperature Range Limit	Set temperature range limit for cooling, heating, or auto mode.	Each Group	Each Group
Schedule	Set up to 8 operations per day, 7 days per week. Operations include time on/off, mode and room temperature set point.	Each Group	Each Group
Test Run	Operates air conditioner units in test run mode. *2 The display for test run mode will be the same as for normal start/stop (does not display “test run”).	Each Group	Each Group *2
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit.	Each Group	N/A
Set Temperature Range Limit	Set temperature range limit for cooling, heating, or auto mode.	Each Group	Each Group
Schedule	Set up to 8 operations per day, 7 days per week. Operations include time on/off, mode and room temperature set point.	Each Group	Each Group

## 5.05 CENTRALIZED CONTROLLER (WEB-ENABLED)

## A. Master Centralized Controller:

1. The Master Centralized Controller shall be capable of controlling a maximum of two hundred (200) indoor units across multiple CITY MULTI outdoor units with the use of three expansion controllers. The Master Centralized Controller shall be approximately 11-5/32" x 7-55/64" x 2-17/32" in size and shall be powered with an integrated 100-240 VAC power supply. The Master Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. When being used alone without the expansion controllers, the Master Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the Master Centralized Controller shall include on/off operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, fan speed setting, and airflow direction setting. Since the master provides centralized control, it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the Master Centralized Controller shall allow the user to define both daily and weekly schedules (up to 24 scheduled events per day) with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

Master Centralized Controller			
Item	Description	Operation	Display
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collective
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat. (Group of Lossnay unit: automatic ventilation/vent-heat/interchange/normal ventilation) Operation modes vary depending on the air conditioner unit. Auto mode is available for the R2/WR2-Series only.	Each Block, Group or Collective	Each Group

Temperature Setting	Sets the temperature from 57°F – 87°F depending on operation mode and indoor unit.	Each Block, Group or Collective	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. *1. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can be scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Night Setback Setting	The function helps keep the indoor temperature in the temperature range while the units are stopped and during the time this function is effective.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *3. Centrally Controlled is displayed on the remote controller for prohibited functions.	Each Block, Group or Collective	*3 Each Group



Room Temp	Displays the room temperature of the group. Space temperature displayed on the indoor unit icon on the touch screen interface.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed *4. When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collective
Outdoor Unit Status	Compressor capacity percentage and system pressure (high and low) pressure (excludes S-Series)	Each ODU	Each ODU
Connected Unit Information	MNET addresses of all connected systems	Each IDU, ODU and BC	Each IDU, ODU and BC
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between "Hi", "Low" and "Stop". When setting a group of only free plan LOSSNAY units, you can switch between "Normal ventilation", "Interchange ventilation" and "Automatic ventilation".	Each Group	Each Group
Multiple Language	Other than English, the following languages can be selected: Spanish, French, Japanese, Dutch, Italian, Russian, Chinese, and Portuguese.	N/A	Collective
External Input / Output	By using accessory cables you can set and monitor the following. Input By level: "Batch start/stop", "Batch emergency stop" By pulse: "batch start/stop", "Enable/disable remote controller" Output: "start/stop", "error/Normal" *5. Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective

3. All Master Centralized Controllers shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to a network switch for IP communication to up to three expansion controllers for display of up to two hundred (200) indoor units on the main master centralized controller interface.
4. The Master Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.
5. Standard software functions shall be available so that the building manager can securely log into each master centralized controller via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics.

Additional optional software functions of personal browser for PCs and MACs and Energy shall be available but are not included. The Energy Apportionment function shall require a LIC-Charge software license

C. Expansion Controller:

1. The Expansion Controller shall serve as a standalone centralized controller or as an expansion module to the Master Centralized Controller for the purpose of adding up to 50 indoor units to the main touch screen interface of the master centralized controller. Up to three (3) expansion controllers can be connected to the master via a local IP network (and their IP addresses assigned on the master) to the master to allow for up to two hundred (200) indoor units to be monitored and controlled from the master interface.
2. The expansion controllers have all of the same capabilities to monitor and control their associated indoor units as the features specified above. Even when connected to the master and configured to display their units on the main controller, the individual indoor units connected to the expansion can still be monitored and controlled from the interface of the expansion. The last command entered will take precedence, whether at the wall controller, the expansion or the master Centralized Controller.

D. Non-Touch Screen, Networked Centralized Controller:

1. The Non-Touch Screen, Networked Centralized Controller shall be capable of controlling a maximum of 50 indoor units across multiple CITY MULTI outdoor units. The controller shall be approximately 8-1/2"x10" in size and shall be powered by its internal power supply. The controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, free contact interlock configuration and malfunction monitoring. The controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the controller shall include on/off operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, temperature setting, fan speed setting, and airflow direction setting. Since the controller provides centralized control, it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

<b>Non Touch Screen, Networked Centralized Controller</b>			
<b>Item</b>	<b>Description</b>	<b>Operation</b>	<b>Display</b>
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collective
Operation Mode	Indoor unit modes: COOL/DRY/FAN/AUTO/HEAT. Lossnay unit modes: HEAT RECOVERY/BYPASS/AUTO Air to water (PWFY) modes: HEATING/HEATING ECO/HOT WATER/ANTI-FREEZE/COOLING *Operation modes vary depending on the unit model connected. ** Auto mode is available for the R2/WR2-Series only.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit model.  Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.	Each Block, Group or Collective	Each Group
Set Temperature Range Limit	The range of room temperature setting can be limited by the initial setting depending on the indoor unit connected.	Each Group	Each Group

Fan Speed Setting	Available fan speed settings depend on indoor unit model.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	*Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. *2. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can be scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group
Hold	Disables scheduled functions for indoor unit groups and their associated remote controller timers. *not available for general equipment	Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Fan Speed, Air Direction and Reset filter). *3. Centrally Controlled is displayed on the remote controller for prohibited functions.	Each Block, Group or Collective	*3 Each Group
Room Temp	Displays the room temperature of the group.	N/A	Each Group
Room Humidity	Displays the percent relative humidity in the space as sensed by the Smart ME Remote Controller	N/A	Each Group
Occupancy Sensor	Displays the occupancy icon on the group icon in the condition list page when the room is occupied (blue) or vacant (gray). *The Smart ME Remote Controller Occupancy sensor is required.	N/A	Each Group

Brightness Sensor	Displays the brightness icon on the group icon in the condition list when the space is determined to be bright (yellow) or dark (gray). *The Smart ME Remote Controller Brightness sensor is required.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed *4. When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collective
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between "Hi", "Low" and "Stop". When setting a group of only free plan LOSSNAY units, you can switch between "Normal ventilation", "Interchange ventilation" and "Automatic ventilation".	Each Group	Each Group
Multiple Language	Other than English, the following languages can be selected: Spanish, French, Japanese, German, Italian, Russian, Chinese, and Portuguese.	N/A	N/A
External Input / Output	By using accessory cables you can set and monitor the following. Input: By level: "Batch start/stop", "Batch emergency stop"; By pulse: "batch start/stop", "Enable/disable remote controller" Output: "start/stop", "error/Normal" *5. Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective
M-Net	The "M-NET" LED lights, when AC power supply is turned ON. The LED blinks while M-NET is communicating.	N/A	Each Group (LED)
Collective ON/OFF	All the units can be operated / stopped with a DIP switch.	Collective	N/A
Measurement	Displays the Temperature and Humidity inputs of the AI Board. Supports graph display and data export.	N/A	Each Unit

AHC Status	Displays the status of the of the inputs and outputs of each Advanced HVAC Controller (DC-A2IO)	N/A	Each Unit
Free Contact Status	Displays the input/output status of the Free Contacts on the indoor units	N/A	Each Unit
Free Contact Interlock Control	Operation of indoor groups, general equipment or free contact outputs based on group(s) conditions or free contact(s) input states.	Each Group, Output or Collective	N/A
Data Back-up (PC)	Initial setting data can be exported to a PC.	Collective	N/A

2. All Non-Touch Screen, Networked Centralized Controller shall be equipped with two RJ-45 Ethernet port to support interconnection with a network PC and BACnet/IP communication via a closed/direct Local Area Network (LAN). The controller shall be capable of performing initial settings online via a PC using the controller's initial setting browser or online/offline with the Initial Setting Tool.
3. Standard software functions shall be available so that the building manager can securely log into each controller via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Standard software functions shall not expire. Additional optional software functions of personal browser for PCs and MACs and Energy Allocation shall be available. The Energy Allocation function shall require Master Centralized Controller Energy Allocation Integrated System in conjunction with Non-Touch Screen, Networked Centralized Controller.

## PART 6 – TRANE/MIT

### 6.01 General

- A. VRF Manufacturer shall provide on-site *Project Supervision* as outlined in this specification section, providing onsite technical review of installed VRF systems, review of activities related to the installation of the VRF system, VRF system components and associated controls.
- B. All *Project Supervision* field activities shall be completed by an employee of the VRF manufacturer whose primary job responsibilities are to provide direct technical support of their product; sales staff or in-house support staff are not permitted to complete this scope of work.
- C. A factory certified representative may assist the VRF manufacturer's personnel in the completion of certain elements of work contained within this specification. Activities completed by a Factory Certified Representative shall be supervised onsite by the VRF manufacturer. Certified representatives shall be pre-approved prior to bidding.
- D. The installing contractor shall assist the VRF manufacturer, in their completion of the system review and have available onsite a technician with appropriate diagnostic tools, materials and equipment, as required, for the duration of the inspection process. The technician assisting the VRF manufacturer shall be fully licensed and insured to complete necessary duties as directed by the VRF manufacturer.
- E. The installing contractor shall have been certified by the manufacturer to install VRF systems, having attended and successfully completed a minimum 3- day VRF Service & Installation course at an approved training facility. A copy of this certificate shall be presented to the VRF manufacturer prior to the commencement of installation activity.
- F. VRF manufacturer shall provide [4] onsite visits during the course of the project's completion.

Additional site visits, if requested, shall require approval by the owner's representative and will be billed accordingly.

- G. Onsite visits shall be conducted at installation milestones noted below. The installing contractor is responsible to coordinate each visit at the appropriate milestone, giving the VRF manufacturer a minimum 2-week notice prior to each visit.
  - a. Project milestones
    - i. Project Kick Off meeting
    - ii. Site Visit at 25% project completion
    - iii. Site Visit at 50% project completion
    - iv. Final Inspection prior to Commissioning of the VRF System

### 3.02 Project Kick-Off

- A. A project kickoff meeting will be conducted with the installing contractor and appropriate parties with the sole purpose to review the installation of VRF systems being installed.
- B. Kick off meeting shall consist of a single [4] hour meeting with the installing contractor. This meeting shall be completed at the project site and be executed at the beginning stages of the installation of VRF systems.
  - a. Items to be reviewed during the Project kick-off meeting are:
    - i. Presentation of Best Practices & Installation Requirements specific to the VRF system(s) being installed under this scope of work.
    - ii. Review of the project's mechanical design drawings related to the VRF systems being installed. Documents to be provided by the mechanical contractor.
    - iii. Review of VRF Manufacturers design selection software and system design schematic drawings for the system being installed Documents to be provided by the mechanical contractor.
    - iv. Discuss project activity related to the installation of VRF system components
    - v. Establish clear path of communication and project support. Mechanical contractor shall designate an onsite point of contact for all field coordination activities.
- C. The installing contractor shall obtain from the Engineer/Designer of the VRF system a copy of the most current electronic design file used in the design and engineering process of the VRF system being installed. This electronic design file shall have been completed on the VRF Manufacturers software and is the mechanical contractor's responsibility to provide the most current as-built version of this file during the course of the project's installation.
- D. The installing contractor shall provide the VRF manufacturer, for their use, a complete set of HVAC mechanical plans prior to the Kickoff meeting. The mechanical contractor is responsible to updates these plans during the course of the project.

### 3.03 Site Visit

- A. Each site visit shall consist of a single visit, not exceeding an [8] hour period. All visits shall occur during regular business hours of 8:30AM-4PM, Monday thru Friday.
- B. Activities to be completed during each Site-Visit are as follows:
  - a. Meet with designated representative from the VRF installation contractor to discuss field activities and provide technical support related to the VRF systems.
  - b. Review installed VRF systems for compliance with manufacturer's installation, service and engineering specifications.
  - c. Assist the contractor in updating the VRF Design software for as-built purposes and for calculating the appropriate refrigerant charge.
  - d. Provide a field report identifying any installation issues requiring attention. Report shall provide detailed information containing:
    - i. Issue reference number

- ii. Priority Level of issue
- iii. Equipment M# & Reference TAG#
- iv. Status of issue
- v. Description of issue being identified
- vi. Recommendation for corrective action
- vii. Follow-up requirements, if required

### 3.04 Project Close Out Documents

- A. Documents completed during the project Supervision process shall be compiled and presented to the owner's representative at the completion of field activities.
- B. Close out documentation shall include
  - a. Project Supervision report outlining activities completed under this scope of work
  - b. As-built VRF design file depicting Model numbers and BTU capacity ratings of equipment charge.
  - c. Issue report

## Part 7 – TRANE/MIT

### 7.01 General

- A. The VRF Manufacturer shall oversee and assist the installing contractor with the startup and commissioning of VRF equipment as outlined below. This process will be completed in two phases. Phase one shall cover the Pre-Start-Up inspection process, Phase two will cover the Physical Start- Up & Commissioning of Equipment.
- B. All *VRF System Commissioning* activities shall be completed by an employee of the VRF manufacturer whose primary job responsibilities are to provide start up and commissioning of their products; sales staff or in-house support staffs are not permitted to complete this scope of work.
- C. A factory certified representative may assist the VRF manufacturer's personnel in the completion of certain elements of work contained within this specification. Activities completed by a Factory Certified Representative shall be supervised onsite by the VRF manufacturer. Certified representatives shall not be used in lieu of the manufacturer's personnel.
- D. The installing contractor shall have been certified by the manufacturer to install VRF systems, having attended a minimum 3- day VRF Service & Installation course at an approved training center. A copy of this certificate shall be presented as part of the VRF equipment submittal process
- E. The installing contractor shall assist the VRF manufacturer in their completion of the system review and have available a technician with appropriate diagnostic tools, materials and equipment, as required, for the duration of the inspection process. The technician shall be fully licensed and insured to complete necessary duties as directed under the supervision of the VRF manufacturer.
- F. Upon completion of the Equipment Start-Up & VRF Commissioning process, the VRF manufacturer shall provide a formal report outlining the status of the system, in electronic format only. Contained within this report shall be copies of all field inspection reports, required action items and status, Manufacturer's design software As-Built, equipment model & serial numbers.
- G. Completion of the Equipment Start-Up and VRF Commissioning process shall verify that the VRF system has been installed per the Engineer's design intent and complies with the VRF manufacturers engineering and installation specifications related to their equipment.
- H. Compliance with federal, state and local codes as well as other authorities having



jurisdictions are not part of this process and are the responsibility of the installing contractor.

- I. Contact your regions Mitsubishi Electric Professional Solutions Manager for information and pricing related to services required under this projects scope of work.

## 7.02 Pre-Start-Up Inspection

- A. Contractor shall employ the services of the VRF manufacturer to provide a comprehensive field review of the completed VRF system installation, prior to the physical start up and operation of equipment. Upon satisfaction that the system meets the VRF manufacturer's installation requirements and specifications, the contractor shall be allowed to proceed with the physical start up and operation of equipment.
- B. Prior to the pre-start-up inspection, all systems components shall be in a final state of readiness having been fully installed and awaiting inspection.
- C. The installing contractor shall provide the VRF manufacturer a copy of the electronic design file used in the design and engineering process of the system being inspected. This electronic design file shall have been completed on software approved by the specified VRF manufacturer and shall have been updated to reflect as-built conditions.
- D. The installing contractor shall have prepared the refrigeration piping systems per equipment installation and service manuals. All refrigerant piping systems, upon completion of assembly, shall have been pressurized to a minimum 600 PSI, using dry nitrogen, and held for an uninterrupted 24HR period, with acceptable change due to atmospheric conditions.
  - a. A record of the pressure check process shall be recorded and tagged at the outdoor unit. The tag shall contain the following information: date & time of pressure check start, fill pressure, outdoor temperature at start & stop, date & time of pressure check completion, and the person's full name & company information completing the pressure check.
  - b. The installing contractor shall engage the General Contractor as a witness of the pressure check process, confirming that all steps and procedures related to the pressure check were properly followed and that the system held the holding pressure of 600PSI for a period of 24hr hours, with acceptable change due to atmospheric conditions. Witness information, including full name, company name, title, phone number and signature shall be recorded on same pressure tag used by installing contractor.
- E. Upon completion of the 600 PSI pressure check, the system shall be evacuated to a level of 500 microns, where it will be held for a period of 1HR with no deflection. The installing contractor shall utilize the triple evacuation method per the equipment install and service manuals.
  - a. Evacuation start & stop dates, times, and persons involved shall be recorded and tagged at the outdoor equipment.
  - b. Installing contractor shall digitally capture a photo of the micron gauge reading, at the conclusion of the 1hr holding period, for each system and provide a copy to the VRF manufacturer. Each photo shall contain a tag providing the outdoor unit's Serial number.
- F. Upon the completion of the 500-micron hold, the calculated additional refrigerant charge can be added. The calculated refrigerant charge shall have been calculated using the VRF manufacturers design software.
  - a. Total refrigerant charge of the system shall be recorded and displayed at the outdoor unit by permanent means.
- G. A review of the equipment settings shall be completed, with recommendations provided to improve system performance, if applicable. Physical changes of system settings will be completed by the contractor. Electronic recording of final DIP switches shall be provided as part of the commissioning report.

- H. A comprehensive review and visual inspection shall be completed for each piece of equipment following a detailed check list, specific to the equipment being reviewed. A copy of the inspection report shall be provided as part of the manufacturers close out documentation. Any deficiencies found during the inspection process shall be brought to the attention of the installing contractor for corrective action. Any system components that are not accessible for proper inspection shall be noted as such.
- I. Indoor Equipment report shall contain:
- a. Model & Serial Number
  - b. Equipment location
  - c. Equipment Tag/Identification number
  - d. Network Address & Port Assignment
  - e. Digital recording of equipment settings
  - f. Mounting/support method
  - g. Seismic restraints used
  - h. Proper service clearance provided
  - i. Wiring and connection points are correct
  - j. High voltage reading(s) within acceptable range
  - k. Low voltage reading(s) within acceptable range
  - l. Type of Remote Controller used and its location
  - m. Occupied space temperature sensing location
  - n. Air temperature readings within acceptable range
  - o. Condensate pump interlock method
  - p. Fan E.S.P. setting
  - q. Air Filter condition
  - r. Height differential setting in heat mode
  - s. Noise level acceptable
  - t. Refrigerant pipe connected and insulated properly
  - u. Condensate pipe connected and insulated properly
  - v. Condition of connected ductwork
  - w. Fresh air connected
  - x. Humidifier connected and checked
  - y. Review of air balance report complete
  - z. Other interlocked systems, i.e. baseboard heat, booster fan etc.
- J. Outdoor Air-Cooled equipment report shall contain
- a. Model & Serial Number
  - b. Equipment location
  - c. Equipment Tag/Identification number
  - d. Network Address & Port Assignment
  - e. Digital recording of equipment settings
  - f. Mounting/support method
  - g. Seismic restraints used
  - h. High Wind Tethering method
  - i. Proper service clearance provided
  - j. Defrost Condensate removal addressed
  - k. Wiring and connection points are correct
  - l. High voltage reading(s) within acceptable range
  - m. Low voltage reading(s) within acceptable range
  - n. Control Network settings
  - o. Noise level setting
  - p. Refrigerant pipe installed and insulated properly
  - q. Low ambient operation settings

#### 4.03 Physical Start-Up & Commissioning of Equipment

- A. Upon proper equipment start up by the contractor, following the manufacturers guidelines and specifications, an employee of the VRF manufacturer shall complete a review of the system performance and complete the following tasks:
- B. Check and confirm all communication addressing of system components.
- C. Check and confirm each indoor unit, individually, is properly piped and wired by commanding the indoor unit on, in either heat or cool mode and verifying proper response.
- D. This process shall be digitally recorded and included as part of the close out documentation.
- E. Electronically record a minimum of one-hour of operational data per refrigeration system.
- F. Electronically record selector switch positions on all indoor and outdoor equipment.
- G. The VRF manufacturer shall retain the electronically recorded data, collected during the start-up and equipment commissioning process, at a designated location within the US for future reference.

#### 4.04 Close-Out Information

- A. The VRF manufacturer shall issue a System Performance report at the completion of all fieldwork. Contained within this report shall be an overview of the system performance, recommendations, field reports, all electronic data, and as-built design file.

**SECTION 23 81 27 - DUCTLESS SPLIT SYSTEM****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 23 05 00 for requirements which are applicable to this section.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish, install, and place into operation ductless split systems as specified herein.
- B. Power wiring will be provided under the Electrical portion of the work.
- C. Control wiring shall be furnished under this portion of the work.
- D. Furnish ductless split system heat pumps or air conditioning units of the quantity, size and capacity shown on the equipment schedules.
- E. System shall be a complete factory package consisting of compressor, evaporator coil, fan and motor, condenser coil fan and motor and complete refrigeration and heat pump temperature controls, and interconnecting wiring and refrigerant piping.
- F. Unit shall be rated in accordance with latest version ARI Standard 380 and shall be U.L. listed.

**1.03 SUBMITTALS**

- A. Submit shop drawings of all equipment.
- B. Submit manufacturers' data sheets of capacity.
- C. Submit wiring diagrams of control system.
- D. Submit piping diagrams of refrigeration interconnection.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.

**PART 2 - PRODUCTS****2.01 INDOOR UNIT**

- A. The unit shall have a self-diagnostic function, 3-minute time delay mechanism.
- B. Factory pre-charge of R410A adequate for 33 feet of total length.
- C. The indoor units shall have a white, "flat screen" finish.
- D. The cabinet shall be supplied with a mounting plate to be installed onto a wall for securely mounting the cabinet.
- E. The cabinet includes an "intelligent-eye" motion sensor capable of setting back the set point

- temperature for energy savings. This feature may be disengaged on the wire remote controller.
- F. The evaporator fan shall be an assembly consisting of a direct-driven fan by a single motor. The fan shall be statically and dynamically balance and operate on a motor with permanent lubricated bearings.
  - G. The return air filter provided will be a removable and washable filter.
  - H. The evaporator coil shall be a nonferrous, aluminum fin on copper tube heat exchanger with factory pressure tested.

## 2.02 OUTDOOR UNIT

- A. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be complete factory assembled and pre-wired with all necessary electronic and refrigerant controls.
- B. The cabinet shall be Ivory White with a finished powder coated backed enamel paint.
- C. The fan shall be a direct drive, propeller type fan.
- D. The motor shall be inverter drive, permanently lubricated type bearings, inherent.
- E. The fan shall be capable of operating in "silent operation" which lowers the outdoor fan speed in either cool, heat or auto modes.
- F. A fan guard is provided on the outdoor unit to prevent contact with fan operation.
- G. The outdoor coil shall be nonferrous construction with corrugated fin tube.
- H. The compressor shall be a rotary swing inverter-driven compressor.
- I. The outdoor unit shall have an accumulator, four-way reversing valve.
- J. The compressor shall have an internal thermal overload.
- K. The outdoor unit can operate with a maximum vertical height difference of 49 feet and overall maximum length of 66 feet without any oil traps, liquid or suction line changes.

## 2.03 REMOTE CONTROLLER

- A. Microprocessor technology with remote controller with LCD display.
- B. Operation Mode Setting (Heat, Auto, Cool/Dry).
- C. Temperature setting (in units of two degrees Fahrenheit)
- D. Self-Diagnostic Display.
- E. Room Temperature Display.
- F. Twenty-Four Hour On/Off Timer.
- G. Fan Speed Indicator.
- H. Auto/Speed Vane Operation
- I. Memory (for storing operation functions)
- J. Low Ambient Operation
- K. Whisper-Quiet Operation
- L. EMS Gateway Available to Management System via RS-232 Cable.

## 2.04 MANUFACTURERS

- A. Manufacturer: Daikin, Mitsubishi, LG.

# PART 3 - EXECUTION

3.01 GENERAL

- A. Install units in accordance with manufacturer's instructions.
- B. Mount compressors on Neoprene pads on roof curbs.
- C. Mount indoor unit on concealed blocking for additional support.
- D. Install pre-charged refrigerant lines through manufactured roof curbs by Pate or equal. Maintain watertight integrity of penetration.

END OF SECTION

**SECTION 23 83 33 - ELECTRIC HEATERS****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 23 05 00 for requirements which are applicable to this section.
- B. Refer to International, NFPA, NEC, and UL requirements for standards relating to these specifications.

**1.02 WORK INCLUDED**

- A. Provide labor, material, equipment, and supervision necessary to install and place into operation all of the equipment specified in this section.

**1.03 SUBMITTALS**

- A. Submit manufacturers shop drawings and catalog data sheets of all items in this section.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's instructions.
- B. Provide benchmark construction for review of the owner and architect prior to installation of remaining units. Benchmark unit shall, after review and approval, become the standard against which all other units will be matched.

**PART 2 - PRODUCTS****2.01 WALL MOUNTED ELECTRIC HEATERS**

- A. Unit to be UL listed, 16-gauge front panel, baked enamel finish, fully enclosed fan motor permanently lubricated, with integral thermostat.
- B. Units to be by QMark, Markel, Berko or preapproved equal

**2.02 CABINET UNIT HEATERS**

- A. Unit to be UL listed, cold rolled steel enclosure with baked enamel finish, direct drive blower and motor, 2 speed, overheat protection, integral thermostat, and cleanable filters.
- B. Manufactured by QMark, Markel, Berko or preapproved equal

**2.03 WALL MOUNTED AND PEDESTAL HEATERS**

- A. Unit to be U.L. listed and of the size and capacity indicated on the drawings.
- B. Units shall have top extruded aluminum grille and two finished sides. Heating elements shall

be cal-rod type element installed within aluminum tubes mechanically expanded into aluminum fins and suspended between junction boxes, factory installed raceway, and baked enamel finish in color selected by the Architect.

- C. Manufacturers; QMark, Markel, Berko or preapproved substitute.

#### 2.04 FAN FORCED WALL HEATERS

- A. Unit to be U. L. listed and of the size and capacity indicated on the drawings.
- B. Overheat protection, integral thermostat, nickel chromium alloy heating elements, permanently lubricated motor, 3 position switch.
- C. Finish to be selected by Architect.
- D. Manufacturers: QMark, Markel, Berko, or preapproved substitute.

#### 2.05 ELECTRIC UNIT HEATERS - SUSPENDED

- A. Built in or remote thermostat as indicated on the drawings.
- B. Mounting brackets.
- C. Totally enclosed, permanently lubricated motor.
- D. Element steel finned sheath, zinc plated.
- E. Auto reset cutout, UL listed.
- F. Manufacturer: Markel, Berko, QMark or preapproved equal

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Coordinate locations and rough-in requirements with other trades prior to installation.
- B. Coordinate electrical requirements with the electrical contractor prior to purchasing equipment. Verify voltages and amperages for feeders.
- C. Provide for benchmark construction as described above.
- D. Adjust, place in service, and provide instructions, guarantees, and maintenance manuals to the owner.
- E. Install electrical heat tracing cable in conformance with the manufacturer's recommendations. Test heating circuits before insulating. Arrange with electrical contractor for electrical power circuits.

END OF SECTION



**CONTENTS**

**DIVISION 26 - ELECTRICAL**  
**DIVISION 27 - COMMUNICATIONS**  
**DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**

<b><u>SECTION</u></b>	<b><u>TITLE</u></b>		
26 00 00	STANDARD CONDITIONS FOR ELECTRICAL WORK		STANDELEC
26 05 26	GROUNDING SYSTEMS: GENERAL		GROUNDIN
26 09 00	LIGHTING CONTROLS		LTGCONTR
26 24 16	PANELBOARDS	PANEL	PANELBRD
26 27 00	BASIC MATERIALS AND EQUIPMENT - COMM LOW		COMMLOW
26 28 16	SAFETY SWITCHES - GENERAL DUTY		SAFETYSW
26 30 00	EMERGENCY LTG AND POWER SYSTEM – DIESEL	GENER	DIESELGEN
26 36 23	AUTOMATIC TRANSFER SWITCH	GENER	ATS
26 43 13	SURGE SUPPRESSION		SURGSUPP
26 50 00	LED LIGHTING		LIGHTING
26 60 00	SERVICE AND DISTRIBUTION		SER&DIST
27 05 28	LOW VOLTAGE CONDUIT SYSTEM (TELEPHONE)		TELEPHON
28 30 00	FIRE ALARM AND DETECTION SYSTEMS - ADDRESS HORN	F.A.	ADDHORN

**DIVISION 26 - ELECTRICAL****SECTION 26 00 00 - STANDARD CONDITIONS FOR ELECTRICAL WORK****PART 1 - GENERAL****1.01 REGULATIONS, CODES, STANDARDS**

- A. Reference Codes, applicable sections of the following codes and standards shall be considered as binding to the work of this project:
- |       |   |
|-------|---|
| NEMA  | National Electrical Manufacturers' Association    |
| NEC   | National Electrical Code (NFPA 70) - 2017 Edition |
| NECA  | National Electrical Contractors' Association      |
| NEIS  | National Electrical Installation Standards        |
| EGSA  | Electrical Generating Systems Association         |
| IBC   | International Building Code                       |
| NFPA  | National Fire Protection Association              |
| IEEE  | Institute of Electrical and Electronics Engineers |
| UL    | Underwriter's Laboratories, Inc.                  |
| IES   | Illuminating Engineering Society                  |
| OSHA  | Occupational Safety and Health Administration     |
| ANSI  | American National Standards Institute             |
| ASTM  | American Society for Testing and Materials        |
| FM    | Factory Mutual                                    |
| IRI   | Industrial Risk Ensurers                          |
| ISO   | Insuring Services Office                          |
| IPCEA | Insulated Power Cable Engineers Assoc.            |
| ADA   | Americans with Disability Act                     |
| NETA  | International Electrical Testing Association      |
- B. All local codes are to be incorporated.
- C. The latest adopted codes and latest editions of standards shall be the basis of conformance.
- D. Obtain and pay for all permits and inspections, and any associated charges.
- E. Inspection Agency Certificate of Inspection to be provided at completion of the work. Inspection by Middle Department Inspection Agency, Inc., or other local inspection agency.
- F. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.
- G. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

**1.02 SUBMITTALS**

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the architect/ engineer. Submissions will

- be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
  - D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
  - E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
  - F. Contractor shall provide performance test data and wiring diagrams of all electrical equipment.
  - G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, shall be combined in a single brochure clearly identifying all items being furnished.
  - H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and shall be coordinated with all other trades.
  - I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified to be clear as to what is being provided.
  - J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/ travel/ access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.
  - K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150.00 per hour billable to the contractor.

### 1.03 SUBSTITUTIONS

- A. Substitution of other than specified manufacturers shall not be allowed after bid date.
- B. Prior approval is required for other manufacturers. If the contractor wishes for alternate materials or equipment to be considered, he must submit information at least ten days prior to the bid date. If acceptable, an addendum will be issued allowing the contractor to utilize the approved alternate.
- C. Samples shall be provided when directed by the architect or engineer.
- D. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service provided by the engineer at the rate of \$150.00 per hour. Also billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval, or rejection.

- E. If the contractor elects to submit alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the drawings and specifications, it is the contractor's responsibility to coordinate the work with other trades and pay for any associated costs with the substitution or change.
- F. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

#### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and equipment in manufacturer's original cartons or on skids.
- B. Store materials in dry enclosure out of way of work progress.
- C. Protect equipment, fixtures, and lenses after placement.

#### 1.05 REFERENCE

- A. Requirements established within the portions of this Project Manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and Addenda as issued are part of this specification.
- C. Electrical drawings along with all other project drawings represent the work of this Division.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

#### 1.06 WORK SUMMARY

- A. Provide labor, materials, equipment, and supervision necessary to install complete, operating electrical systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the require work.
- B. Contractor shall provide all demolition necessary to remove, replace, repair, install new or modify existing work whether it be walls, floors, ceilings, structure, mechanical or electrical required to install his work. Contractor shall replace all work to leave in a finished condition. Pipe, conduit, ductwork, and wiring shall be cut back behind wall surfaces above ceilings and below floor levels so that a patch can be placed over the opening.
- C. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
- D. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- E. Provide roof penetrations for electrical work and all associated roof work.
- F. \* Provide 3 phase, 4 wire electrical service of the size as indicated on the drawings at 208Y/120 V with distribution to all equipment 208V, luminaires and general-purpose receptacles at 120V.
- G. Provide fire alarm system with battery backup, horns, strobes, pull stations, annunciator panel, duct

- detectors, and all associated controls and appurtenances.
- H. Provide exit and emergency luminaires throughout with emergency power supply in addition to normal power.
  - I. Provide power to HVAC and plumbing equipment as necessary to have complete, operating systems.
  - J. Provide luminaires throughout, with exterior luminaires at all egress doors.
  - K. Provide site luminaires for all parking areas, roadways, walkways, as well as security luminaires.
  - L. Provide telephone conduit system. Provide (2) CAT 3 plenum rated telephone cables from the telephone demarcation point to the fire alarm control panel for the auto dialer.
  - M. Provide Uninterruptible Power Supply System (UPS) with input filter, transformer, battery, and all associated controls and appurtenances.
  - N. Provide grounding system for facility in accordance with the NEC.
  - O. Provide addressable security system with battery back-up, intrusion detection sensors, signal equipment, system controls, alarm displays, alarm indicating devices, telephone auto dialer, and manual keypads to change system status, wiring methods, and appurtenances.
  - P. Provide communication/ sound system throughout complete with controller, receivers, CD/ tape decks, microphones, speakers, antennae, loudspeakers, equipment racks, wiring methods, and appurtenances.
  - Q. Base bid is to provide all primary cable, transformer coils, busways, switchboards, panelboards, and all feeders as copper conductors. Alternate bid is to provide all as aluminum conductors of equivalent current carrying capacity.
  - R. Provide code required signage (i.e., NEC 110.34, NEC 700.8, and 695.4 B3).
  - S. Provide third-party certification of all packaged systems by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399 as well as Pamphlet #70 and NEC Article 90.7.
  - T. Refer to Commissioning of Systems Specification for additional scope of work.

#### 1.07 SITE INSPECTION

- A. Visit site, inspect, and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of a bid will be deemed evidence of being in compliance with this requirement. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.
- C. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

#### 1.08 UTILITY CONNECTION AND CHARGES

- A. The contractor shall be responsible for coordination of the work with the Electric Utility Company. Make all arrangements in a timely fashion for connection of the service.
- B. The Electrical Contractor shall be responsible for utility connection charges, meter charges, and other installation charges as may be applied by the local utility company.
- C. Contact the utility company during the bidding period for connection charges and include same with bid.
- D. Provide connections, terminations, handholes, manholes, pads, transformers, vaults, conduits, wiring, and all required materials and labor as may be required by the utility company to obtain service for the facility. Any costs for service work shall be included in the bid.

## 1.09 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- B. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.
- C. If there is a conflict between the drawings and specifications it is to be understood that the more strict or more expensive interpretation shall govern. Also, if a conflict exists between specification sections or between drawing plans and details, it is to be understood that the more strict or more expensive interpretation shall govern.
- D. The architect's or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.
- E. If a question arises after bidding the architect's and/ or engineer's interpretation shall govern.
- F. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.

## 1.10 MINIMUM INTEGRATED EQUIPMENT SHORT CIRCUIT RATING:

- A. Where the contract documents indicate secondary service from the utility Company (208/120V, 3 phase, or 480/277V, 3 phase) available short circuit currents including system motor contribution (amperes RMS symmetrical) at the line terminals of the UL service entrance labeled main distribution panelboard or switchboard, shall be in accordance with the following tabulation:

Service Minimum	Service Entrance	Panelboard Rating	Transformer Rating
kVA	%Z	208/ 120V	480/ 277V
75	1.5	14,500	10,000
112.5	1.5	22,000	10,000
125	1.5	29,000	13,000
225	1.5	43,000	19,000
300	1.5	58,000	25,000
500	1.5	96,000	42,000
750	5.5	42,200	18,000
1000	5.5	56,100	24,500
1500	5.5	85,000	37,000
2000	5.5		49,000
2500	5.5		51,000
3000	5.5		73,500

- B. The Integrated Equipment short circuit rating of the main distribution panel, or switchboard shall meet or exceed the tabulated minimum values. This shall be construed to mean that the equipment withstands capability (bus-bracing), and interrupting capacities of main and feeder devices, shall each meet or exceed the tabulated minimum values.
- C. Service transformer ratings shall be as indicated on the drawings. If said ratings are not indicated, the contractor shall contact the engineer and/ or utility company for clarification.
- D. The only deviations from this tabulation that are permissible shall be the results of a short circuit

study (if and as specified in Section 26 05 73 Power System Studies), or documented data from the utility company.

#### 1.11 PROGRESS SCHEDULE

- A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

#### 1.12 COST SCHEDULE

- A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.
- B. AIA forms are required for this submission.

#### 1.13 OFFICE

- A. The contractor shall set up his job office (desk) where directed by the owner.

#### 1.14 STORAGE

- A. Material shall be stored only where directed by the owner.

#### 1.15 SANITARY

- A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
- B. Toilet will be located where directed by the owner.

## **PART 2 - PRODUCTS**

#### 2.01 GENERAL

- A. All materials and equipment shall be new and in present production of major manufacturers.
- B. All materials and equipment shall be in conformance with accepted trade standards as a minimum. Where specifications exceed any minimum standard, the specifications shall govern.
- C. Reference of equipment in the singular shall be deemed to apply to as many such items as may be required to complete the work.
- D. The word "provide" means "furnish and install complete, tested, and adjusted as necessary with all accessories, wiring methods, switching, lenses, mounting hardware, cover plates, hangers and supports".

#### 2.02 FASTENERS AND SUPPORTS

- A. All work shall be securely fastened to building construction.
- B. Utilize toggle or machine bolts in hollow construction.
- C. Utilize machine screws for steel construction.
- D. Utilize expansion shields for masonry construction.
- E. Utilize lag bolts for wood construction.

- F. All fasteners shall be galvanized or plated with rustproof finish.
- G. Maximum load on fasteners shall be at a safety factor of 4:1 for a tested sample.

## 2.03 MOTOR STARTERS AND CONTACTORS

- A. Single-phase manual motor starters with overloads shall be provided under the electrical portion of the work for fractional horsepower motors up to ½ HP.
- B. Polyphase motor starters and motor starters above ½ HP shall be furnished under other portions of the work.
- C. The starters in A, or B above shall be installed under the electrical portion of the work.
- D. Polyphase starters shall be magnetic combination type, across-the-line, electrically operated, electrically held, three-pole assemblies, with arc-extinguishing characteristics, silver-to-silver renewable contacts, three-pole thermal bi-metallic, red "run" pilot light, individual phase protection, with overload heaters matched to motors installed and with four auxiliary contacts, Hand-Off-Auto switch, and control transformer.
- E. For single-phase motors above ½ HP provide magnetic combination, single-phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing, auxiliary contacts.
- F. Starters shall be as manufactured by G.E., Cutler Hammer, Siemens, Square D or Allen Bradley.
- G. Contactors shall be across-the-line, electrically operated, mechanically held three-pole assemblies for tungsten and ballast luminaire loads. Acceptable manufacturers: GE, Cutler Hammer, Siemens, Square D or Allen-Bradley.
- H. Manual motor starters without overloads in NEMA 1 enclosure equal to G. E. Type TC shall be used for the following load:
  - 1. 30 amperes or less, continuous.
  - 2. 1 HP or less at 120 volts
  - 3. 2 HP or less at 240 volts

## 2.04 MANUFACTURERS' NAMES

- A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any deviations from this must be acknowledged during the bid phase by the supplier, who shall be solely responsible for any and all costs associated with the application of their product(s) in the project.
- B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

## PART 3 - EXECUTION

### 3.01 WELDING

- A. All electric power for arc welding shall be supplied by the contractor performing the work.



### 3.02 VEHICLES

- A. Vehicle access to the site will be as directed by the owner.

### 3.03 RUBBISH DISPOSAL

- A. Except for items or materials identified to be reused, salvaged, reinstalled, or otherwise indicated to remain property of the owner or tenant, demolished materials shall become the contractor's property and shall be removed, recycled, or disposed from the project site in an appropriate and legal manner.
- B. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

### 3.04 WORKMANSHIP

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.
- C. Plug or cap open ends of piping systems and conduit.
- D. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
- E. Protect all installed work until accepted in place by the owner. Protect luminaires.
- F. Do not install plates, covers, and other finished devices until masonry, tile, and painting operations are complete, or protect otherwise.
- G. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulation and covering.
- H. All devices and exposed raceways are to be plumb and true. All exposed raceways in finished areas are to be coordinated with the architect/engineer prior to installation.

### 3.05 SCAFFOLDING

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

### 3.06 SITE UTILITIES

- A. The contractor may use the existing water and electric power for temporary construction needs.
- B. The owner will direct where these services may be tapped.
- C. Those services that are used during construction, but are to remain, shall be refurbished to a new condition before turning back over to the owner.

### 3.07 CLEAN-UP

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Remove all trash and debris from the premises.

### 3.08 LUBRICATION

- A. Furnish and install and maintain all required lubrication of any equipment operated prior to acceptance by the owner. Lubrication shall be as recommended by the equipment manufacturer.
- B. Provide one year's supply of lubricants to owner at date of acceptance.
- C. Verify that required lubrication has taken place prior to any equipment start-up.

### 3.09 EQUIPMENT START UP

- A. Verify proper installation by manufacturer or his representative.
- B. Advise the architect and engineer two days prior to actual start up.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to the architect and engineer.

### 3.10 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner's personnel in the operation and maintenance of all systems and equipment.
- B. Ensure that the owner's personnel are familiar with all operations to carry on required activities.
- C. Such installation shall be for each item of equipment and each system as a whole.
- D. Provide report that instruction has taken place. Include in the report the equipment and/ or systems instructed, date, contractor, owners' personnel, vendor, and that a full operating and maintenance manual has been reviewed.
- E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalog cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers, and emergency contacts. Three manuals shall be provided to owner.
- F. Submit manuals for review prior to operating instruction period. Manuals shall be 8 1/2" x 11" with hard cover, suitably bound.
- G. Provide to the owner any special tools necessary to operate any of the equipment.

### 3.11 PENETRATION SEALING

- A. All penetrations of Natatorium walls, fire walls, smoke walls, and floors shall be sealed around conduits and wiring to prevent the flow of gases or smoke.
- B. The sealant shall be foamed in place between the conduit or wiring and the adjacent walls and floors with Dow/ Corning RTV foam or Fire Stop Caulk.
- C. All penetrations through roof structure shall be coordinated with other trades to minimize the potential for water seepage and leakage through such penetrations.
- D. When electrical boxes are located on opposite side of a fire resistance rated wall assembly are within 2'-0" horizontally of each other, both devices are to be wrapped with Spec Seal Putty Pads as manufactured by Specified Technologies, Inc., or approved equivalent.

### 3.12 EQUIPMENT SETTING

- A. Furnish and install as a minimum, a 0'-4" high concrete pad beneath all floor-mounted equipment.
- B. Furnish and install as a minimum, spring vibration isolators under any equipment 10 HP and over and rubber-in-shear vibration isolation under all equipment less than 10 HP.
- C. Reinforce concrete with No. 4 rods 12'-0" on center, both ways.
- D. Pad to have 3/4" dowels into concrete at one per four square feet.

### 3.13 INSTALLATION MOUNTING HEIGHTS

- A. To be verified by Architect, but in general shall be as follows (top of device elevation above finished floor):

Lighting switches, controls:	3'-10"
Duplex receptacles:	1'-8"
Duplex receptacles over counters:	0'-8" above countertop
Telephone data wall plate and modular jack, desk phone:	1'-8"
Telephone, data wall plate and modular jack, wall phone:	3'-10"
Special outlets:	As required for equipment
Fire alarm annunciating devices:	85"
Fire alarm manual pull stations:	3'-10"
Clock receptacles:	As indicated on drawings.
CATV wall plates and modular jacks:	1'-8"
CATV wall plates and modular jacks mounted near ceiling:	Coordinate mounting height with Architect.
Thermostats (forward reach):	3'-10"
Thermostats (side reach):	3'-10"
Thermostats with lockable cover:	4'-6"

Requirements of the Americans with Disability Act and/or ANSI A117.1 shall be met.

- B. Structural and mechanical details shall be coordinated before roughing in.

### 3.14 COORDINATION

- A. Coordinate with work of other trades prior to installation.  
B. Arrange for minor variations for complete coordinated installation. Provide all necessary offsets to install the work and to provide clearances for other trades.

### 3.15 CUTTING AND PATCHING

- A. Provide for cutting and patching for all electrical work.  
B. Patching to be performed by tradesmen skilled in that particular trade.  
C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

### 3.16 BALANCING AND TESTING

- A. Electrically balance connected loads in panels.  
B. The entire wiring system shall be tested to be free from grounds and faults.  
C. Identify all circuits and all phase wiring at terminations.

### 3.17 EQUIPMENT FURNISHED BY OTHERS

- A. This contractor shall make final electrical connections to equipment furnished by other contractors or the owner.

- B. Provide electrical service, and disconnect equipment as required by code to supply such equipment.

### 3.18 EXCAVATION, SHORING, PUMPING, BACKFILLING

- A. Perform all excavation required to install the work. Deposit excavated material as so not to create a slide hazard.
- B. Maintain excavations free of water.
- C. Backfill with clean material and pneumatically tamp in 0'-8" layers. Remove excess material, including rock, from site or as directed by the architect and engineer.
- D. Return to original conditions any areas disturbed for excavation.
- E. Install all work neatly, trim, and plumb with building lines.
- F. Install work in spaces allocated.
- G. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

### 3.19 RECESSES

- A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment, and/ or devices which are to be recessed in walls.
- B. Make offsets or modifications as required to suite final locations.

### 3.20 LABELING

- A. All equipment panels, controls, safety switches, and devices shall be provided with permanent black laminated micarta white core labels with 3/8" high letters.
- B. This shall also apply to all controllers, remote start/ stop pushbuttons, equipment cabinets, and wherever directed by the architect and engineer.
- C. This shall not apply to individual room thermostats, and local light switches.

### 3.21 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the owner unless otherwise specified.
- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.

### 3.22 AS BUILT DRAWINGS

- A. At the completion of the work and prior to final payment, the contractor shall furnish a reproducible as-built drawing to the architect and engineer for approval. The drawings shall indicate all work installed and its actual size, and location and identify all systems installed with locations of concealed devices, conduit, piping and other equipment and complete wiring diagrams of all systems. If acceptable, the architect and engineer will submit the as-built drawings to the owner as record drawings. If not acceptable, the architect and engineer return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
- C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the

format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150.00 per hour billable to the contractor.

### 3.23 SAMPLE CONSTRUCTION

- A. (One double and one single patient room) (one apartment) (one tenant space) shall be constructed and approved by the owner, architect/ engineer, and local code officials (electrical inspector or underwriter, building code official, fire marshal) before all other rooms are constructed.
- B. This room shall represent the standard against which all others will be constructed.
- C. Installation will include all units, ducts, piping, wiring, fixtures, devices, etc. which are required for complete rooms.

### 3.24 MAIN ELECTRICAL ROOM DRAWING

- A. Provide 3/8" = 1'-0" scale drawings of the Main Electrical Room indicating all electrical, mechanical, plumbing, telephone, security, fire alarm and life safety equipment to be installed within this room. Exact dimensions of equipment, pads, etc., are to be indicated. Show two cross sections at important points.
- B. Obtain information from other subs as appropriate.
- C. Submit for review and approval along with electrical equipment submittals. Equipment will not be approved prior to review of this drawing.

### 3.25 GENERAL ELEVATOR REQUIREMENTS

- A. The Electrical Contractor shall furnish and install an elevator safety switch sized to match the requirement of the elevator motor. Switch shall be located within the Elevator Machine Room on the strike side of the entrance doorway. The Electrical Contractor shall provide the branch circuit to the safety switch and make terminations between the switch and the elevator motor.
  - 1. For machine room less equipment, Switch shall be located within the Elevator Control Space.
- B. Furnish and install a 20 Amp dedicated circuit and disconnect switch for the elevator cab(s) lighting system. The disconnect switch is to be located within the Machine Room on the strike side of the entrance doorway. This circuit is to be ground fault protected.
  - 1. For machine room less equipment, Switch shall be located within the Elevator Control Space.
- C. Furnish and install a dedicated 20 Amp circuit for the elevator pit and Machine Room. Furnish and install GFCI receptacle and two, 2'-0" L LED strip luminaires located within the elevator pit (final quantity shall be as required to provide minimum illuminance per the elevator manufacturer). Pit devices and luminaire control are to be located adjacent to pit access.
  - 1. For machine room less equipment, GFCI device shall be located within the Elevator Control Space. Luminaire and control shall not be required within the Elevator Control Space.
- D. Furnish and install a telephone back box and conduit in the Elevator Machine Room for the elevator cab telephone circuit and local telephone jack.
  - 1. For machine room less equipment, telephone back box and conduit for the elevator cab telephone circuit and local telephone jack shall be located within the Elevator Control Space.
- E. Furnish and install smoke detectors for elevator recall at each elevator lobby when building is three stories or more. These automatic initiation devices are to be interlocked with elevator controller and building Fire Alarm Control Panel. Heat detectors are to be provided in the Machine Room and at the top and bottom of the elevator shaft.

1. For machine room less equipment, devices associated with the Machine Room shall not be required.
- F. When an automatic sprinkler system is present, automatic initiation devices for elevator power shut down are to be provided. These heat detectors are to be located within 2'-0" of all sprinkler heads in the Elevator Machine Room and Elevator Shaft. See Elevator Shunt Trip paragraph for further requirements.
  1. For machine room less equipment, devices associated with the Machine Room shall not be required.
- G. Furnish and install fire rated enclosures for the back boxes of any electrical devices recessed in the walls of the elevator equipment room or shaft. Walls are fire rated.
- H. Furnish and install two 20 Amp 120V circuits for sump pump and sump pump alarm. Coordinate with plumbing contractor.

### 3.26 ELEVATOR SHUNT TRIP (SPRINKLED BUILDING)

- A. The elevators are required to be provided with a shunt trip circuit breaker serving the equipment. All feeder circuit breakers (both on normal and emergency/standby power sources) are to be provided with the shunt trip device. The activation of the shunt trip is to be in the sequence described below.
  1. Upon activation of the fire alarm system by any manual or automatic means, including the smoke detectors required for recall, a signal is sent from the fire alarm control panel to the elevator controller to initiate recall of the elevator to the lowest non-fire floor. Upon activation of the 135°F heat detector located within 2'-0" of all sprinkler heads in either the Elevator Machine Room, the Elevator Pit or the top of the shaft, a signal is sent from the fire alarm control panel to immediately shunt-trip the power supply. This sequence will allow the elevator to be recalled to the lowest non-fire floor before the shunt trip is activated. The sprinkler heads in the Elevator Machine Room and elevator shaft are to be rated at 200°F, which will allow the shunt trip to activate prior to the sprinkler head.

### 3.27 WORK COMPLETION

- A. The contractor shall promptly correct work rejected by the engineer or failing to conform to the requirements of the contract documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed, or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

### 3.28 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

- A. All RFI's shall include the following information based on AIA Document G716:
  1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
  2. Provide a description with specification and/or drawing references.
  3. Provide the senders recommendation including cost and/or schedule considerations.
  4. Provide receiver's reply space.
  5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

### 3.29 SHOP DRAWING REQUIREMENTS

- A. The following is a list of required shop drawings for this project.

<b>ELECTRICAL</b>	<b>DATE REC'D</b>	<b>ACTION</b>	<b>DATE REC'D</b>	<b>ACTION</b>
Basic Materials and Equipment (Section 26 05 00 and 26 27 00)				
Panelboards (Section 26 24 16)				
Safety Switches - (Section 26 28 16)				
Automatic Transfer Switch (Section 26 36 23)				
Surge Suppression (Section 26 43 13)				
Lighting (Section 26 50 00 and 26 09 00)				
Emergency Power System (Section 26 30 00)				
Fire Alarm and Detection Systems (Section 28 30 00)				
Low Voltage Systems (CCTV, Security, DATA, Phone Entry, etc.)				
As-Builts				
Warranties				
Maintenance Manuals				
Instructions				
Ground Test				

END OF SECTION

**SECTION 26 05 26 - GROUNDING AND BONDING SYSTEMS: GENERAL****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of system described in other Sections.
- B. Related Sections include the following:
  - 1. 26 41 13 - LIGHTNING PROTECTION for additional grounding and bonding materials.

**1.03 SUBMITTALS**

- A. Product Data - For the following:
  - 1. Ground rods.
  - 2. Chemical rods.

**1.04 Qualification Data: For firms and persons specified in 1.05 QUALITY ASSURANCE Article.**

- A. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

**1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in PART 3 - EXECUTION.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.
- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.



**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Grounding Conductors, Cables, Connectors, and Rods:
    - a. Chance/ Hubbell
    - b. Copperweld Corp.
    - c. Erico Inc.; Electrical Products Group.
    - d. Framatome Connectors/Burndy Electrical
    - e. Galvan Industries, Inc.
    - f. Ideal Industries, Inc.
    - g. Kearney/ Cooper Power Systems.
    - h. Korns: C.C. Korns Co.; Division of Robroy Industries.
    - i. Lyncole XIT Grounding.
    - j. O-Z/Gedney Co.; a business of the EGS Electrical Group.\
    - k. Racor, Inc.; Division of Hubbell.
    - l. Salisbury: W.H. Salibury & Co.
    - m. Superior Grounding Systems, Inc.
    - n. Thomas & Betts, Electrical

**2.02 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Section 26 27 00.
- B. Material: Aluminum, copper-clad aluminum, and copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two band of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
1. Solid Conductors: ASTM B 3.
  2. Assembly of stranded Conductors: ASTM B8.
  3. Tinned Conductors: ASTM B33.
- H. Copper Bonding Conductors: As follows:
1. Bonding Cable: 28 kcmil, 14 strands of #17 AWG copper conductor, 1/4" Ø.
  2. Bonding Conductor: #4 or #6 AWG, stranded copper conductor.
  3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules: 1-5/8" wide and 1/16" thick.
  4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules: 1-5/8" wide and 1/16" thick.
- I. Aluminum Bonding Conductors: As follows:
1. Bonding Cable: 10 strands of #14 AWG aluminum conductor 1/4" Ø.
  2. Bonding Conductor: #4 or #6 AWG, stranded aluminum conductor.
  3. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules: 1-5/8" wide and 1/16" thick.
- J. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. #4 AWG aluminum, soft-drawn copper conductor.
  2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, cypress, or cedar.
- K. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

## 2.03 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per

## 2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
- B. Ground Rods: Section type; copper-clad steel.
  1. Size: 5/8" Ø.
- C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a #4/0 bare conductor. Provide backfill material recommended by manufacturer.

# PART 3 - EXECUTION

## 3.01 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  1. Use insulated spacer; space 0'-1" from wall and support from wall 0'-6" above finished floor, unless otherwise indicated.
  2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
- F. Underground Grounding Conductors: Use tinned copper conductor, #2/0 AWG minimum. Bury at least 2'-0" below grade or bury 1'-0" above duct bank when installed as part of the duct bank.

## 3.02 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA

- 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
  - C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
    - 1. Feeders and branch circuits.
    - 2. Single-phase motor branch circuits.
    - 3. Three-phase motor branch circuits.
  - D. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  - E. Bond metal parts, motor frames, fittings, plumbing pipes, drains, metal conduit, metal surfaces within 5'-0", and all electrical devices and controls within 5'-0".
  - F. Motors shall be grounded by means of a grounding conductor in the same raceway with the motor feeder connected to the grounding bushing at the motor terminal box and the ground bus in the motor control center or to the incoming conduit grounding bushing of an individually mounted motor starter.

### 3.03 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

### 3.04 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For #8 AWG and larger, use pressure-type grounding lugs. #10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to

grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

1. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- F. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.05 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
  1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81. (Ensure that the test is performed with all ground-to-neutral bands broken. The grounding system must be completely isolated for the test to be valid.)
  3. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

**SECTION 26 09 00- LIGHTING CONTROLS****PART 1 - GENERAL****1.01 REFERENCE**

- A. This section includes manually operated, digital lighting controls with external signal source, relays, and control module.
- B. Refer to Section 26 00 00 for other requirements of this section.
- C. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.
- D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- F. Comply with NFPA 70 National Electrical Code (NEC).
- G. Refer to 26 27 00 for other lighting controls (switches, motion sensors, etc.).
- H. Provide interior lighting controls to meet the adopted IBC / IECC / ASHRAE 90.1 code.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install complete, operating, lighting control system specified herein.
- B. All rooms are to be provided with lighting controls. Provide manual switch and code required control devices as appropriate. If controls are not indicated within a space, controls are to be provided for the space in a similar manner as adjacent or similar spaces.

**1.03 SUBMITTALS**

- A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
  - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
  - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
  - 3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
- C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and system specified in other Sections.
  - 1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
  - 2. For networked controls, list network protocols and provide statements from

manufacturers that input and output devices meet inter-operability requirements of the network protocol.

3. Show equipment locations on floor plans of similar scale as contract documents.
- D. Field quality control test reports.
- E. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- F. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

#### 1.04 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
  1. Match components and interconnections for optimum performance of lighting control functions.
  2. Coordinate lighting controls with HVAC controls. When specifically indicated on lighting control system riser diagram, design display graphics showing building areas controlled; include the status of lighting controls in each area.
  3. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

#### 1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Failure of software input/output to execute switching or dimming commands.
    - b. Failure of modular relays to operate under manual or software commands.
    - c. Damage of electronic components due to transient voltage surges.
  2. Warranty Period: Two years from date of Substantial Completion.

#### 1.06 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

## PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Leviton Mfg. Company Inc.
  2. Hubbell Lighting Controls.
  3. Lithonia Lighting; Acuity Lighting Group, Inc.

4. Lutron Electronics Company, Inc.
5. ETC Lighting Control Systems.
6. Watt Stopper (The).

## 2.02 SYSTEM REQUIREMENTS

- A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.
- B. Performance Requirements: Manual switch operation, an internal timing and control unit and external sensors, send a signal to Programmable system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads.

## 2.03 CONTROL MODULE

- A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); Microprocessor based, solid-state, 365-day timing and control unit. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. An integral alphanumeric LCD or LED shall display menu-assisted programming and control.

## 2.04 POWER DISTRIBUTION COMPONENTS

- A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.
  1. Cabinet: Steel with hinged, locking door.
    - a. Barriers separate low-voltage and line-voltage components.
    - b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
    - c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
  2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
    - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
    - b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
    - c. Endurance: 50,000 cycles at rated capacity.
    - d. Mounting: Provision for easy removal and installation in relay cabinet.

## 2.05 MATERIALS

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 27 00 Section "BASIC MATERIALS."
- B. Class 1, 2, and 3 Control Cables: Multi-conductor cable with copper conductors as

- recommended by the manufacturer.
- C. Control wiring methods are to be per approved brand and part number of the lighting control manufacturer. No substitutions will be permitted.
- D. Manual Controllers: Comply with Division 26 27 00 Section "BASIC MATERIALS."

### **PART 3 - EXECUTION**

#### **3.01 WIRING INSTALLATION**

- A. Comply with NECA 1.
- B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- E. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

#### **3.02 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Test for circuit continuity.
  - 2. Verify that the control module features are operational.
  - 3. Check operation of local override controls.
  - 4. Test system diagnostics by simulating improper operation of several components.

#### **3.03 SOFTWARE INSTALLATION**

- A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

#### **3.04 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

#### **3.05 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel



to adjust, operate, and maintain lighting controls and software training for PC-based control systems.

END OF SECTION

**SECTION 26 24 16 - PANELBOARDS****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for additional requirements of this section.
- B. Refer to requirements of the National Electrical Code, UL, and the NFPA.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install panelboards as specified.

**1.03 SUBMITTALS**

- A. Submit manufacturers shop drawings of all equipment specified in this section.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturers' warranty requirements.

**PART 2 - PRODUCTS****2.01 DISTRIBUTION PANELBOARDS (MDP or PP)**

- A. **GENERAL** - Furnish and install distribution and power panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.
- B. **BUSSING ASSEMBLY AND TEMPERATURE RISE** - Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Bus shall be plated copper.
- C. **CIRCUIT BREAKERS** - Circuit breakers shall be equipped with individually insulated, braced, and protected connectors. Circuit breakers shall be flush with each other. Tripped indication shall be clearly shown. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Mechanical lugs are to be copper. For 480 V applications over 1000 Amp, the main breaker is to include electronic trip with LSIG characteristics.
- D. **\*\* EQUIPMENT SHORT CIRCUIT RATING (FULLY RATED)** - Each panelboard shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
- E. **CABINET** - Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters

shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel. Baked enamel finish electro-deposited over cleaned phosphatized steel.

- F. SAFETY BARRIERS - The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.
- G. UL LISTING - Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When required, panelboards shall be suitable for use as service equipment.
- H. NAMEPLATES - Provide laminated black phenolic resin with white core with 3/16 inch high engraved lettered nameplates for each circuit breaker to indicate the feeder, panelboard and equipment served. Mounted, with plated screws, adjacent to or on front of the breaker.
- I. Panelboards shall be by Square D, Siemens, Cutler Hammer or ABB Group.

## 2.02 LIGHTING & RECEPTACLE PANELS (LP or RP)

- A. GENERAL - Furnish and install circuit breaker lighting panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic molded case circuit breakers with frame and trip ratings as shown on the schedule.
- B. CIRCUIT BREAKERS - Shall be quick-make, quick-break, thermal-magnetic, trip indicating and have common trip on all multipole breakers. Trip indication shall be clearly shown by the breaker handle taking position between "ON" and "OFF" when the breaker is tripped. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V AC and carry the SWD marking. UL Class A ground fault circuit protection shall be provided on 120V AC branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker. A UL listed combination arc fault circuit interrupter (AFCI) shall be provided for all 120V, 15 or 20 Amp branch circuits as indicated on the plans or panelboard schedule or as required by the National Electrical Code. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for the branch circuit wiring. This breaker shall require no more panelboard branch circuit space than a conventional circuit breaker. Connections to the bus shall bolt-on.
- C. PANELBOARD BUS ASSEMBLY - Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single phase, three-wire panelboard bussing shall be such that any two adjacent single pole breakers are connected to opposite polarities in such a manner that two pole breakers can be installed in any location. Three phase, four-wire bussing shall be such that any three adjacent single pole breakers are individually connected to each of the three different phases in such a manner that two or three pole breakers can be installed at any location. All current carrying parts of the bus assemble shall be plated copper. Main's ratings shall be shown in the panelboard schedule or on the plans.
- D. WIRING TERMINALS - Terminals for feeder conductors to the panelboard mains and neutral

- shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type of conductor specified.
- E. CABINETS AND FRONTS - The panelboard bus assemble shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA and UL Standards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel.
  - F. Fronts shall include doors and have flush, cylinder tumbler-type locks with catches and spring-loaded stainless-steel door pulls. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge steel.
  - G. \*\* EQUIPMENT SHORT CIRCUIT RATING (FULLY RATED) - Each panelboard shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
  - H. UL LISTING - Panelboards shall be listed by Underwriters Laboratories and bear the UL label. Equal panelboards may be provided by Square D, G.E., Cutler Hammer, or Siemens.
  - I. ELECTRONIC GRADE - Panels indicated to be electronic grade to have 200% rated neutrals, and an isolated ground bar in addition to the equipment ground bar.

### **PART 3 - EXECUTION**

#### **3.01 PANELS**

- A. Tops not to exceed 72 inches above floor.
- B. Provide labeling and complete directories.
- C. Ductwork or piping shall not pass over panels.
- D. Space shall be clear 36" in front of panel floor to structural slab or roof above.
- E. All conduit entering the panel shall have a screwed hub with an insulated bushing and no sharp edges.
- F. Wires shall be labeled and neatly arranged in the wiring gutters with wires cut to proper lengths and neatly racked.
- G. Electronic grade panels shall have feeder neutrals rated at 200% to maintain the UL listing of the panel and be provided with isolated ground conductor back to service entrance or feeder transformer.

#### **3.02 GROUNDING**

- A. All panels shall be grounded to the building equipment grounding system per NEC 408.40. Ground resistance shall not exceed NEC values.

END OF SECTION

**SECTION 26 27 00 - BASIC MATERIALS AND EQUIPMENT FOR METAL RACEWAY SYSTEMS****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for additional requirements of this section.
- B. Refer to NECA 1-2000 for general installation requirements.

**1.02 SUBMITTALS**

- A. Submit shop drawings and manufacturers catalog sheets of all specified items unless waived by the engineer.
- B. Submit switches and receptacles as a minimum.

**PART 2 - PRODUCTS****2.01 RIGID METAL CONDUIT (GRS)**

- A. Material: Steel, Zinc coated Federal Specification WW-C-581d, ANSI C801.
- B. Fittings: Malleable iron, Threaded.
- C. National Electrical Code; Article 344
- D. Application: Indoor, above ground, enamel coated, all occupancies not subject to severe corrosive influences.
- E. Manufacturer: Hubbell, Allied Tube and Conduit Corp. or approved equal.

**2.02 ELECTRICAL METALLIC TUBING (EMT)**

- A. Material: Galvanized steel, U.L. labeled, Federal Specification WWC-563 (latest revision), ANSI C80.3.
- B. Fittings: Threadless compression type for up to 1-1/4", set screw for 1-1/2" and larger. Installation in accordance with Article 358 of the National Electrical Code and U.L. general information card #FJMX.
- C. National Electrical Code; Article 358
- D. Application; Exposed and concealed work not subject to physical damage.
- E. Manufacturer: Hubbell, Allied Tube and Conduit Corp. or approved equal.

**2.03 FLEXIBLE METAL CONDUIT**

- A. Material: Hot dipped galvanized interlocking convolutions of steel tape in circular cross section. Federal Specification WW-C-566.
- B. Fittings: Hot dipped galvanized steel
- C. National Electrical Code; Article 360
- D. Application: All areas other than wet locations, hoistways, hazardous locations, below

ground, and areas with exposure to oil, gasoline, or other materials having an adverse effect on rubber.

- E. Manufacturer: Electri-flex Company Liqueflex Type BR, Hubbell, Allied Tube and Conduit Corp., AFC.

#### 2.04 RIGID NON-METALLIC CONDUIT (SCHEDULE 40 PVC)

- A. Material: U.L. 651, ANSI/ NEMA TC-2, Fed. Military Spec. WC-1094A, 90 deg. wire rated and sunlight resistant.
- B. Fittings: PVC, same as above.
- C. National Electrical Code; Article 352
- D. Application: In walls, floors, ceilings, wet locations, underground, and locations subject to severe corrosive influences.
- E. Manufacturer: Carlon Schedule 40 electrical conduit or approved equal.

#### 2.05 LIQUATITE FLEXIBLE METAL CONDUIT

- A. Material: Hot dipped galvanized interlocking convolutions of steel tape in circular cross section with PVC jacket.
- B. Fittings: Hot dipped galvanized steel.
- C. National Electrical Code Article 350 (LFMC)
- D. Application: All areas other than elevator hoistways, hazardous locations and where subject to physical damage.
- E. Manufacturer: Electrifiex Company Liqueflex Type LT, Hubbell, Allied Tube and Conduit Corp., AFC.

#### 2.06 CONDUCTORS

- A. Type; THHN, 98% conductivity copper, 600-volt, dry locations. Type THWN for wet locations. Conductors shall be U.L. listed.
- B. Equipment terminations for circuits rated 100 Amps or less (#14 AWG-#2 AWG) shall be rated 60°C (140°F). Equipment termination for circuits rated over 100 Amps (#1 AWG or larger) shall be rated 75°C (167°F). Refer to National Electrical Code for allowable exceptions. 90°C (194°F) rated conductors shall be used as indicated on the drawings or as indicated within these specifications.
- C. Solid copper conductors for #10 AWG and #12 AWG wire size. #8 AWG and larger shall be stranded copper.
- D. Separate green ground conductor for all circuits including branch, homerun, and feeders.
- E. All conductors shall be color coded as follows:  
120/ 208 Volt Systems  
Phase A        Black  
Phase B        Red  
Phase C        Blue  
Neutral Grey or Natural White
- F. Minimize size conductor shall be #12 AWG except that #14 AWG shall be used for control wiring. All circuit conductors shall be run in the same raceway system.
- G. A grounding conductor shall be provided to each electrical device in accordance with the National Electrical Code.
- H. Conductor sizes shall be as shown on drawings and/ or specified in this specification.
- I. Conductors shall not be installed in raceways until construction is advanced to allow conductors to be installed completely without damage to conductors and there is not

possibility of water or other contaminants entering the raceway system. Conductors shall be installed between convenient terminating points.

- J. An approved pulling compound shall be used to assist in pulling of conductors.
- K. Aluminum Alloy Conductors for Distribution Feeder Applications:
  - 1. Distribution feeder conductor's sizes #6 AWG to 1,000 Kcmil may be copper (Base Bid) or aluminum alloy (Alternate). Aluminum alloy conductors shall be compact standard conductors of a recognizable Aluminum Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy). AA-8000 series alloy conductor must be Alcan Cable Stabiloy or approved equal.
  - 2. Compliance with the elongation requirement per Table 10.1 of UL Standard 1581 for stranded AA-8000 series aluminum alloy conductors shall be determined on wires taken from the conductor after stranding by manufacturer.
  - 3. Insulation:
    - a. For use in raceways: Type XHHW-2, temperature rating 90o C.
    - b. For use in cable trays: Sizes #1/0 AWG and larger. Type XHHW-2, temperature rating 90°C and marked: "SUN RES", "VW-1", "GASOLINE AND OIL-RESISTANT II", "FOR CT USE".
- L. Manufacturer: Alpha Wire, Southwire, Tamaqua Cable, Triangle Wire & Cable, American Insulated Wire, BICC or General Cable.

## 2.07 JUNCTION BOXES

- A. Material: Galvanized steel, accessible.
- B. Manufacturer: Keystone, Hubbell, Penn Panel and Box Co.
- C. National Electrical Code; Article 314

## 2.08 OUTLET AND SWITCH BOXES

- A. Material: Galvanized steel with knockouts to suit raceway system.
- B. Manufacturer: Crouse Hinds Co., Steel City Div., Raco Inc., or approved equal.

## 2.09 WALL PLATES - THERMOSET PLASTIC - RESIDENTIAL GRADE

- A. Wall plates shall be standard size, thermoset plastic, residential grade.
- B. Plates shall be provided for all switches, receptacles, blanks, telephone, and special purpose outlets.
- C. Plates may be of modern design having rounded edges and corners and be complete with color-matched mounting screws.
- D. Plates must be of one design throughout the building and shall conform to UL, CSA, and NEMA standards.
- E. Engraving shall be done by plate manufacturer in accordance with the schedule.
- F. Acceptable Manufactures: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton

## 2.10 WALL PLATES - STAINLESS STEEL - TYPE 302 - CORROSIVE/ DAMPNESS/ FOOD SERVICE DUTY

- A. Wall plates shall be Pass and Seymour Sierra Series "S", Type 430 Stainless Steel, or "S-N" line Type 302 Stainless Steel or equal and will conform to UL and NEMA standards.
- B. Plates must be provided for all switches, receptacles, blanks, telephone, and special purpose outlets.
- C. Plates shall be of a modern design, having rounded edges and corners and be complete with

finish-matching mounting screws.

- D. Engraving shall be done by plate manufacturer in accordance with the schedule.
- E. Plates must be of one design throughout the building.
- F. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.

## 2.11 RECEPTACLES - STANDARD DUTY - COMMERCIAL/ SPECIFICATION GRADE

- A. All thermoplastic nylon body construction.
- B. Impact-resistant nylon face.
- C. One-piece triple-wipe brass power contact.
- D. Available with side and back wire capable of accepting #14 AWG-#10 AWG copper or copper-clad wire.
- E. Terminal compartments isolated from each other for positive conductor containment.
- F. Automatic grounding clip assures grounding to metallic boxes.
- G. Easily accessible break off tabs to facilitate split circuit wiring.
- H. Plated steel strap for corrosion resistance.
- I. Combination Phillips/ slotted head screws backed out for ease of installation.
- J. In compliance with UL 498.
- K. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- L. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- M. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- N. Leviton 5362/ 5361, 20 Amp, ivory, white, grey, black, brown, or almond.

## 2.12 RECEPTACLES - DECORA - SPECIFICATION GRADE

- A. Impact-resistant nylon face.
- B. One-piece, triple-wire brass power contacts.
- C. Corrosion resistant, plated, wrap-around steel strap locked into assembly to prohibit strap from bending away from body.
- D. Terminal compartments isolated from each other for positive conductor containment.
- E. Available in hospital grade and specification grade.
- F. Heavy-duty compact design for easier installation and long-lasting performance.
- G. Automatic grounding clip standard for positive ground to metal boxes.
- H. All devices fit standard #26 opening wall plate.
- I. Side and back wire accepts #14 AWG-#10 AWG.
- J. In compliance with UL 498.
- K. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- L. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- M. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- N. Leviton 16352, 20 amp, white, ivory, grey, black, or almond.

\* Those receptacles installed on the emergency system shall be clearly identifiable as distinct from normal system receptacles. (red)

## 2.13 GROUND FAULT CIRCUIT INTERRUPTING RECEPTACLES - STANDARD GRADE

- A. Side or screw pressure plate back wire with #14 AWG or #12 AWG solid or y-stranded



- copper wire.
- B. Extra-long strap.
- C. High-impact resistant thermoplastic construction.
- D. Ground screw with a wire guide channel.
- E. Dual-direction test and reset buttons.
- F. Line and load terminations supplied backed out, and ready to wire.
- G. Two back wire holes per terminal.
- H. Ultrasonic welding of face to back body.
- I. Mis-wire label applied to load terminals.
- J. GFCI Receptacle shall have SafeLock™ protection. If critical components are damaged and ground fault protection is lost or if mis-wired, power to receptacle is disconnected.
- K. Class A rated GFCI
- L. 1-1/2 HP rating on Motor Control GFCI switch (2081 series).
- M. Button colors match the device face.
- N. Supplied with matching wall plate.
- O. In compliance with UL-943, UL-498, UL-508.
- P. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- Q. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- R. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- S. Leviton 6898, 20 Amp, ivory, white, almond, or mahogany.

#### 2.14 TAMPER RESISTANT RECEPTACLES - COMMERCIAL

- A. Thermoplastic shutter for reliable tamper-resistant design.
- B. High-impact thermoplastic face and body.
- C. One-piece Brass Alloy grounding system.
- D. High performance copper alloy contacts assure the highest degree of blade retention.
- E. Ground contacts are encapsulated in thermoplastic body.
- F. Side or back wiring accepts #10 AWG, #12 AWG or #14 AWG copper.
- G. Eight hold back wiring for convenient feed thru wiring.
- H. In compliance with UL-498.
- I. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- J. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- K. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- L. Leviton 8300-SG, 20 Amp, ivory, white, grey, red, or brown.

#### 2.15 RECEPTACLES - FLOOR OUTLET

- A. Solid brass covered plate with matching flush fitting brass cap.
- B. Receptacle made of durable thermoplastic.
- C. Supplied with foam rubber gasket. O-ring and metal 18" cubic box.
- D. In compliance with UL 498.
- E. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- F. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- G. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.

H. Leviton 5362/ 5361, 20 Amp, ivory, white, grey, black, brown, or almond.

## 2.16 TOGGLE SWITCHES - COMMERCIAL DUTY SPECIFICATION GRADE

- A. One-piece brass alloy contact arm.
- B. Thermoset body and cover for superior heat resistance.
- C. High strength polycarbonate toggle resists breaking and chipping under heavy abuse.
- D. Available with side wire or side and back wire models capable of accepting #14 AWG-#10 AWG copper or copper-clad wire.
- E. Cam designed for fast make with positive break action to minimize arcing and prolong switch life.
- F. Heavy-duty toggle bumpers for smooth and quiet operation.
- G. Oversized silver alloy contacts for longer dependable switch life.
- H. Plated steel strap for corrosion resistance.
- I. Combination Phillips/ slotted head screws backed out for ease of installation.
- J. In compliance with UL 20.
- K. Switches shall be Federal Specification WC596 compliant. Marking should be clearly identifiable on face or strap.
- L. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- M. Leviton CS120-2/ CS320-2/ CS420-2, 20 Amp, 120/ 277-volt, ivory, white, black, grey, or almond.

## 2.17 ROCKER SWITCHES - STANDARD GRADE

- A. Designer-style matte-finish rocker.
- B. High-impact resistant thermoplastic construction.
- C. Side or speed wire #14 AWG-#12 AWG.
- D. Smooth, quiet paddle action.
- E. Easy-access green hex head ground screw.
- F. Combination head screws.
- G. Framed rocker.
- H. In compliance with UL 20.
- I. Switches shall be Federal Specification WC596 compliant. Marking should be clearly identifiable on face or strap.
- J. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- K. Leviton 5601/ 5603/ 5604, 15 Amp, 120/ 277-volt, ivory, white, grey, almond, black, or brown.

## 2.18 AC MOTOR RATED SWITCH

- A. 30 Amp and/ or 40 Amp, 600-volt AC rated.
- B. Double pole or triple pole, single throw.
- C. UL 508, UL 94 (flammability) Listed.
- D. All molded parts are made of thermoplastic material to assure superior resistance to repeated impact, chemical degradation, extreme temperature fluctuations, tracking and arcing.
- E. Positive-contact design enhances fast make/ slow break mechanism by minimizing bounce and arcing upon contact closure and teasing upon separation.
- F. Free-travel toggle design protects closed contacts from accidental disengagement and contact teasing.
- G. Silver alloy contacts provide maximum conductivity and prolonged service life.
- H. Side and back wire terminal screws accept up to #10 AWG solid copper wire.

- I. For standard #8 AWG wire, remove terminal clamp and use ring terminal.
- J. Oversized #10, triple-combination, vibration-resistant terminal screws.
- K. Mounting yoke is made from nickel-plated brass for superior corrosion resistance.
- L. Insulating barriers between terminal screws provide isolation from each phase.
- M. Devices are permanently marked with catalog number, amperage, voltage, and horse-power ratings to assist with identification.
- N. Large toggle provides positive actuation, even when operated with gloved hand.
- O. Leviton MS302 (30 Amp, 2-Pole), MS 303 (30 Amp, 3-Pole), MS402 (40 Amp, 2-Pole) or MS403 (40 Amp, 3-Pole) or equivalent by Cooper Wiring Devices, Pass & Seymour, Hubbell.

## 2.19 DIMMER SWITCHES - DECORA SLIDE TYPE- SPECIFICATION GRADE

- A. Maximum ratings are for continuous full load.
- B. RFI suppression built in.
- C. Extra-heavy use models supplied with matching cover.
- D. Leviton 80800/ 80800-3/ 81000/ 81000-3/ 82000/ 82000-3, 800-watt, 1,000-watt, 2,000-watt-120-volt, 277-volt.
- E. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour (Titan Series), Hubbell, Leviton.
- F. Full on bypass.
- G. Ivory, white, grey.
- H. Pre-set on-off switch.

## 2.20 SURFACE METAL RACEWAY AND WIREWAY

- A. Provide surface metal raceway system complete with all fittings, wiring, devices, etc. Surface raceway shall have baked enamel finish.
- B. These raceways are permitted only in dry locations where not subject to severe physical damage and must have metal not less than .04" thick. Do not use in hoistways and in any hazardous classified areas.
- C. The number, type, and size of conductors permitted in raceway shall be clearly marked on raceway or on shipping label.
- D. Splices and taps may be made providing raceway has an accessible removable cover.
- E. Wireway made of 14-gauge sheet metal forming a square trough with hinged cover and complete with couplings, 90 deg. elbows, tees, junction boxes, end plates, and supports may be used for surface wiring at load centers and other locations to the extent permitted by the National Electrical Code.
- F. Wireways in sizes 2-1/2" x 2-1/2" up to 12" x 12" square may be used; however, no conductor larger than that which the wireway is designed shall be installed therein. Wireway shall not contain more than thirty current carrying conductors at any cross-section and the sum of cross-sectional areas of all contained conductors at any cross-section shall not exceed 20% of the interior cross-sectional area of wireway.
- G. Wireways shall be treated with rust resistant primer and finished gray baked enamel.

## 2.21 MC CABLE

- A. Type: UL listed Type MC Cable with galvanized steel armor outer casing, color coded circuit conductors, insulated green grounding conductor. Each conductor insulated with thermoplastic insulation.
- B. National Electrical Code; Article 330, 518 and to comply with Federal Specification J-C-30B.
- C. Manufacturer: AFC Cable Systems MC, Alean Cable, BICC, Tamaqua Cable.

**2.22 FIRE ALARM MC CABLE**

- A. Type: UL listed Type MC Cable with galvanized steel armor outer casing, bare grounding conductor, color coded circuit conductors. Each conductor insulated with thermoplastic insulation.
- B. National Electrical Code; Article 760 and to comply with Federal Specification J-C-30B.
- C. Manufacturer: AFC Cable Systems Fire Alarm Cable or approved equal.

**2.23 RECESSED FLOOR BOX (CONCRETE FLOOR)**

- A. One, two, or three-gang box, cast iron for on or below grade, stamped steel for above grade.
- B. Fully adjustable before and after concrete pour.
- C. Shallow box as necessary.
- D. Removable dividers as necessary for multi-service applications.
- E. One, two, or three-gang cover plates; Carpet, tile, or brass as per application.
- F. Walker Wiremold Omnibox Multiservice Floor Box series.
- G. Acceptable Manufacturers: Wiremold, Hubbell, Thomas & Betts, Crouse Hinds.

**2.24 MULTISERVICE FLUSH POKE-THRU (4" FLOOR CORE)**

- A. Flush poke-thru with four Category 5 communications jacks and power.
- B. Communication adapter for protection of Category 5 cables.
- C. EMI/ RFI shielded divider, UL recognized.
- D. Manufacturers furnish 20 Amp isolated grounding specification grade duplex receptacle.
- E. Two-hour fire rating, UL Listed.
- F. Grommets for unused data jack parts (coordinate with data communications contractor).
- G. Wiremold 4ATCP4RBK Category 5 Flush Poke-thru.
- H. Acceptable Manufacturers: Wiremold, Hubbell, Thomas & Betts, approved equivalent.

**2.25 THREE SERVICE FURNITURE FEED POKE-THRU (3" FLOOR CORE)**

- A. Flush poke-thru for telephone, data, and power (up to ten wire) feeds to furniture partitions.
- B. Communication adapter for protection of communications cables.
- C. Up to four-hour UL Listed fire rating as indicated on drawings or specifications.
- D. Wiremold RC9AM2TC - 6A series flush poke-thru.
- E. Acceptable manufacturers: Wiremold, Hubbell, Thomas & Betts.

**2.26 MULTISERVICE RECESSED WALL BOX (FLAT SCREEN TVs, MONITORS)**

- A. Three-gang box, plastic housing, white finish. Flush mount appearance allows for snug-to-wall placement of flat-screen TV or monitor.
- B. Surge-protective duplex power outlet and up to 12 multimedia connections.
- C. Position either line voltage or low voltage devices in all three openings.
- D. Low voltage connectors offer both terminated and pull-through capability so plugs, and multimedia connections stay recessed behind the surface of the wall.
- E. Accepts standard TP wall plate.
- F. Legrand TV3WTVSSW. (ACTS standard)
- G. Acceptable Manufacturers: Hubbell, Thomas & Betts.

**2.27 INDOOR OCCUPANCY SENSORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Lighting.
  2. Leviton Mfg. Company Inc.
  3. Lithonia Lighting; Acuity Lighting Group, Inc.
  4. Novitas, Inc.
  5. RAB Lighting, Inc.
  6. Sensor Switch, Inc.
  7. TORK.
  8. Watt Stopper (The).
  9. Pass & Seymour
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of one to 15 minutes.
  2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  3. Relay Unit: Dry contacts rated for 20 Amp ballast load at 120-volt and 277-volt AC, for 13 Amp tungsten at 120-volt AC, and for 1 HP at 120-volt AC. Power supply to sensor shall be 24-volt DC, 150 mA, Class 2 power source as defined by NFPA 70.
  4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2" knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  6. Bypass Switch: Override the on function in case of sensor failure.
  7. Automatic Light-Level Sensor: Adjustable from 2-200 footcandles; keep lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 0'-6" minimum movement of any portion of a human body that presents a target of not less than 36 square inches.
  2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1,000 square feet when mounted on an 8'-0" high ceiling.
  3. Detection Coverage (Corridor): Detect occupancy within 90'-0" when mounted on a 10'-0" high ceiling.
- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 1'-0" in either a horizontal or a vertical manner at an approximate speed of 1'-0" per second.
  2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 square feet. when mounted on an 8'-0" ceiling.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 square feet when mounted on an 8'-0" high ceiling.
  4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2,000 square feet when mounted on an 8'-0" high ceiling.

5. Detection Coverage (Corridor): Detect occupancy anywhere within 90'-0" when mounted on a 10'-0" high ceiling in a corridor not wider than 14'-0"
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
  1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of 0'-6" minimum movement of any portion of a human body that presents a target of not less than 36 square inches and detect a person of average size and weight moving not less than 1'-0" in either a horizontal or a vertical manner at an approximate speed of 1'-0" per second.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 sq. ft. when mounted on an 8'-0" high ceiling.

### **PART 3 - EXECUTION**

#### **3.01 WIRING DEVICES**

- A. Lighting outlet boxes to have 3/8" fixture studs.
- B. Exterior boxes shall be gasketed and watertight.
- C. Switch and device plates to be mounted with all four corners touching adjacent surface.
- D. All devices to be installed true and plumb.
- E. Switch plates and receptacles shall not be placed back-to-back in adjacent rooms. Offset locations a minimum of 0'-3" to restrict noise transfer. This shall also apply to TV outlets, telephone outlets, and data outlets.
- F. All devices on opposite side of a fire resistance rated wall assembly are to be separated by a horizontal distance of not less than 2'-0".
- G. Ground fault circuit interrupters shall be provided on all outdoor receptacle circuits, receptacle circuits within toilet and bathrooms, areas in close proximity to water, and wherever else indicated on the drawings or required by Code. While-in-use type covers are to be used in exterior wet locations.
- H. Tamper resistant receptacles are to be installed where indicated on the drawings. Refer to National Electrical Code 406.11 and 517.18 (C). Arc Fault Circuit Interrupters (AFCI) shall be provided on all 15 Amp and 20 Amp receptacle circuits in dwelling unit bedrooms.
- I. Dimmer switch devices shall be appropriately sized for derating when a minimum of two or more are ganged together in a common wall box.

#### **3.02 WIRING METHODS**

- A. Exposed interior wiring, panel feeders, home runs, equipment feeders; EMT. EMT conduit shall be securely fastened at intervals not exceeding 10'-0" and within 3'-0" of all boxes. NOTE: Exposed indicates all wiring methods is not installed within walls, above suspended ceilings, or within a pre-manufactured raceway. Any raceway that is to be exposed in a finished area is to be coordinated with the architect/ engineer prior to installation.
- B. Concealed branch circuiting above suspended ceilings, and in stud partitions; MC Cable. MC Cable shall be securely fastened at intervals not exceeding 4'-6", and within 1'-0" of all boxes or fittings. All home runs shall be in EMT.
- C. Wiring in concrete slabs or decks is not permitted unless approved by the architect or structural engineer.

- D. Exposed exterior wiring, Intermediate rigid conduit.
- E. Wiring below concrete slabs in earth: PVC conduit. \* Provide GRS conduit sweep elbow through concrete slab.
- F. Service wiring: PVC conduit encased in 0'-2" of reinforced concrete from utility transformer or pole to the building (below slab is not required to be encased).
- G. Concrete encasement: 0'-2" minimum cover around each conduit requiring encasement. Reinforcement consisting of 4" x 4" No. 4 wire mesh on top level of conduit.
- H. Emergency feeder from generator set (if outside building) to building; PVC conduit encased in 0'-2" of concrete, IMC within building.
- I. Minimum conduit size is 3/4".
- J. Flexible connections to all motors. Maximum length of flexible conduit is to be 3'-0".

### 3.03 RACEWAY SYSTEMS

- A. All secondary wiring shall be installed in rigid metal conduit, electrical metallic tubing, or MC Cable as specified in these Specifications.
- B. Electrical metallic tubing shall be employed in lieu of rigid metal conduit in all locations except:
  - 1. Underground
  - 2. In gravel, cinder, concrete, or other sub-base floor construction. PVC may be used under floor.
  - 3. Horizontal runs in concrete floor slabs. PVC may be used in slabs.
  - 4. Where subject to possible mechanical injury
  - 5. In masonry construction below finished grade. PVC may be used.
  - 6. Vertically in poured concrete walls.
  - 7. For service work
  - 8. For main distribution feeders
- C. All raceway components shall be fastened at intervals not exceeding 8'-0".
  - 1. Conduits shall not fasten or come in contact with piping of other trades as installed in this building.
  - 2. Conduit shall be separated not less than 6 inches from any water, steam or gas lines as may be installed in the building.
- D. Conduits and raceway systems shall be run concealed in walls, partitions, and floor slabs. Conduit which must be exposed shall be arranged as to not pass in front of windows, doors, access panels, access doors, sky lights, HVAC equipment access for coil removal or filter removal or required service clearances.
- E. Pulling fittings shall be provided for any conduit run which exceeds 200'-0" in length.
- F. All high voltage conduits (all conduit serving equipment over 600-volt) are to be painted red and labeled "HIGH VOLTAGE" on 10'-0" intervals. This does not apply to conduit below grade.
- G. All exposed fire alarm conduits are to be painted red, unless directed otherwise by the architect. This is to include the 120-volt branch circuit serving the control panel. Junction boxes are to be labeled "FIRE ALARM."
- H. All emergency circuits (MC cable and conduit) are to be painted red unless directed otherwise by the architect. Junction boxes are to be labeled "EMERGENCY 120." Appropriate voltage is to be indicated.
- I. All conduits and raceway components installed under this Section for completion by others shall be provided with a pull wire affixed at both ends of conduit.
- J. Insulating bushings shall be used on all conduit terminations entering enclosures, boxes, and panels to protect the conductor from damage during installation.

### 3.04 POWER WIRING

- A. Wire between motors, starters, disconnects and source.
- B. Verify proper motor rotation. Check for smooth operation.
- C. Furnish and install weatherproof disconnects, as indicated.
- D. All panel feeders shall be run in EMT raceway system.
- E. All wiring to roof top units, fans, and H&V units shall be installed complete between panel, disconnect switches and motor or unit connections.
- F. Disconnects shall be mounted adjacent to electrical and mechanical equipment. Indoor installations shall utilize NEMA 1 enclosures. Outdoor installations shall utilize NEMA 3R, weatherproof enclosures.

### 3.05 GROUNDING

- A. All electrical equipment and systems shall be grounded.
- B. Grounding system shall consist of a ground bus bar connected to a driven ground rod. Utilize ground type clamp fitting.
- C. All connections to conduit, equipment and devices shall be made with compression type connections.
- D. The grounding system shall comply with the National Electrical Code.
- E. All outside lighting fixtures and poles shall be grounded.
- F. All equipment and devices shall be grounded in accordance with the manufacturer's recommendations.
- G. The ground system shall have a resistance of 25 Ohms or less in compliance with the National Electrical Code. Utilize the fall of point method.
- H. Furnish a ground system test report at the completion of the work.
- I. Substation area grounding shall be in accordance with local utility company standards.

END OF SECTION



**SECTION 26 28 16 - SAFETY SWITCHES - GENERAL DUTY**

\* **Residential, light commercial.**

**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 26 00 00 for requirements which are applicable to this section.
- B. Refer to NFPA and in particular National Electrical Code.
- C. Refer to NEMA, UL, and IEEE Standards.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install and place into operation safety switches where indicated on the drawings and specified herein.

**1.03 SUBMITTALS**

- A. Submit manufacturer's shop drawings of devices.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install systems and equipment in accordance with the National Electrical Code and local codes having jurisdiction.
- C. Provide adequate supervision of labor force to see that installations are correct.

**PART 2 - PRODUCTS****2.01 GENERAL DUTY SAFETY SWITCHES**

- A. APPLICATION DATA
  - 30 Amp-600 Amp
  - 240-volts AC
  - NEMA 1 - General Purpose, painted sheet steel
  - NEMA 3R - Rainproof, painted galvanized steel
  - Standard - Non time delay fuse
  - Maximum - Time delay (dual element) fuse
- B. CONSTRUCTION
  - Visible blades
  - Handle attached to box, not cover
  - Handle position indicates "ON" or "OFF"
  - Top hinged cover on NEMA 3R
  - Operating mechanism is quick-make, quick-break

- Plated current carrying parts
- Provisions for padlocking the switch in the "OFF" position
- Class R fuse kits for field installation
- C. NEUTRAL AND GROUNDING
  - Provisions for field installation of insulated, groundable neutral
  - Ground kits for field installation
- D. TERMINALS
  - UL listed for Al or Cu wires
  - UL listed for 60°C, or 75°C wires
- E. FUSE CLIPS
  - Spring reinforced
  - Plated
- F. APPLICATION
  - Fusible - Class H or Class R
  - Not fusible
- G. NEMA STANDARDS
  - KS1 - 1975
- H. UL LISTING
  - UL 98 Enclosed Switches
  - Maximum HP ratings
- I. UL LISTED SHORT CIRCUIT RATING:
  - 100,000 rms symmetrical amperes with proper rejection kit and Class R fuses
  - 10,000 rms symmetrical amperes with Class H fuses
- J. Acceptable Manufacturers:
  - 1. Siemens
  - 2. Cutler Hammer
  - 3. ABB Group
  - 4. Square D

### **PART 3 - EXECUTION**

#### **3.01 SAFETY SWITCHES**

- A. Furnish and install safety switches on all motors which do not have integral equipment disconnect devices, local starters and/ or where indicated on the drawings.
- B. Furnish and install fused safety switches where indicated on the drawings.
- C. Safety switches shall be installed to meet the area classification as to standard, hazardous, rainproof, etc.
- D. Safety switches shall be installed securely to building structure or be provided with supplemental support steel such as angle iron or uni-strut when required to locate on other than building structure.
- E. All safety switches shall be grounded.

END OF SECTION

**SECTION 26 30 00 - EMERGENCY POWER SYSTEM (DIESEL GENERATOR SET)****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for requirements which are applicable to this section.
- B. Refer to the requirements of the National Electrical Code and International codes.
- C. Refer to NFPA codes, particularly Pamphlet 37, 101 and 110.
- D. Refer to NECA/EGSA 404-2000 for general installation requirements.
- E. Refer to NFPA 99 for Health Care facilities.

**1.02 WORK INCLUDED**

- A. Provide labor, material, equipment, and supervision necessary to install a complete (stand-by) (emergency) power system and wiring system for emergency power, emergency lighting, fire alarm system, nurse call, emergency heat, and communications.
- B. System shall be complete with generator, engine, fuel system, ventilation system, exhaust system, (remote) monitoring, control wiring from automatic transfer switches, both new and existing, and concrete base.
- C. Provide labor, material, equipment, fuel, and supervision necessary to install a temporary portable diesel generator of similar size to maintain emergency power system during removal of existing generator and installation of new generator set.
- D. Provide code required signage (NEC 700.7, 701.7 and/or 702.7).

**1.03 SUBMITTALS**

- A. Furnish shop drawings and manufacturers descriptive literature on all aspects of the emergency generator. Include physical data, wiring diagrams, electrical data, installation requirements, operating instructions, and fuel consumption.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.

**PART 2 - PRODUCTS****2.01 GENERATOR SET MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. MTU Onsite Energy
  - 2. Caterpillar, Inc.
  - 3. Generac
  - 4. Cummins Power

## 5. Kohler Co.

## 2.02 ENGINE GENERATOR SET

- A. Furnish a coordinated assembly of compatible components.
- B. Output Connections: 3Ø-4W.
- C. Safety Standard: Comply with ASME B15.1.
- D. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of items.
- E. Limiting dimensions indicated for system components are not exceeded.
- F. Power Output Ratings: Nominal ratings as indicated, 300 KW with capacity as required to operate as a unit as evidenced by records of prototype testing.
- G. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.

## 2.03 GENERATOR-SET PERFORMANCE

- A. Steady-State Voltage Operational Bandwidth: 4% of rated output voltage from no load to full load.
- B. Steady-State Voltage Modulation Frequency: Less than 1 Hz.
- C. Transient Voltage Performance: Not more than 20% variation for 50% step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within three seconds.
- D. Steady-State Frequency Operational Bandwidth: 0.5% of rated frequency from no load to full load.
- E. Steady-State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- F. Transient Frequency Performance: Less than 5% variation for a 50% step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within five seconds.
- G. Output Waveform: At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5% total and 3% for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
- H. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, the system will supply a minimum of 250% of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.
- I. Start Time: Comply with NFPA 110, Type 10, system requirements.
- J. Air requirements: Maximum air requirements for combustion and cooling is to be as follows:

< 50 KW:	125 CFM/KW
50 KW - 100 KW:	90 CFM/KW
100 KW - 200 KW:	75 CFM/KW
> 200 KW:	60 CFM/KW

## 2.04 ENGINE

- A. Comply with NFPA 37.
- B. Fuel: Fuel oil, Grade DF-2.
- C. Rated Engine Speed: 1800 rpm.
- D. Maximum Piston Speed for Two-Cycle Engines: 1725 fpm (8.8 m/s).

- E. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
- F. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:
  - 1. Filter and Strainer: Rated to remove 90% of particles 5 micrometers and smaller while passing full flow.
  - 2. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.
  - 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.
- G. Engine Fuel System: Comply with NFPA 37. System includes the following:
  - 1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
  - 2. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns fuel to source.
- H. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment.
- I. Emissions: Exhaust emissions are to meet latest version of EPA Emission Standards for Compression Ignition Engines.

## 2.05 GOVERNOR

- A. Type: Isochronous

## 2.06 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.
- B. Radiator: Rated for specified coolant.
- C. Coolant: Solution of 50% ethylene-glycol-based antifreeze and 50% water, with anti-corrosion additives as recommended by engine manufacturer.
- D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- E. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
  - 1. Rating: 50-psig (345-kPa) maximum working pressure with 180° F (82° C) coolant, and non-collapsible under vacuum.
  - 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

## 2.07 FUEL SUPPLY SYSTEM

- A. Comply with NFPA 30 and NFPA 37.
- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, listed, and labeled fuel oil tank. Features include the following:
  - 1. Tank level indicators.
  - 2. \*Capacity: Fuel for eight hours of continuous operation at 100% rated power output.
  - 3. Vandal-resistant fill cap.
  - 4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

## 2.08 ENGINE EXHAUST SYSTEM (MUFFLER ONLY BY ELECTRICAL CONTRACTOR)

- A. Muffler: Critical type, sized as recommended by engine manufacturer. Measured sound level at a distance of 10'-0" (3 m) from exhaust discharge, is 85 dBA or less.
- B. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.
- C. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- D. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.
- E. Supports for Muffler and Exhaust Piping: Spring hangers and all-thread rods and vibration hangers attached to building structure.
- F. Exhaust Piping External to Engine: ASTM A 53, Schedule 40, welded, black steel, with welded joints and fittings.
- G. Exhaust piping insulation: 0'-4" high temperature calcium silicate with aluminum jacket.

## 2.09 STARTING SYSTEM

- A. Description: 12V or 24V electric, with negative ground and including the following items:
  - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified.
  - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
  - 4. Battery: Lead Acid with adequate capacity within ambient temperature range.
  - 5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  - 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater is arranged to maintain battery above 10° C regardless of external ambient temperature. Include accessories required to support and fasten batteries in place.
  - 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 Amp minimum continuous rating.
  - 8. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type. Unit complies with UL 1236 and includes the following features:
    - a. Operation: Equalizing-charging rate of 10 Amps is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
    - b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40° C to plus 60° C to prevent overcharging at high temperatures and undercharging at low temperatures.
    - c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10%.
    - d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
    - e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either condition closes contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

## 2.10 CONTROL AND MONITORING

- A. Functional Description: When the mode-selector switch on the control and monitoring panel is in the "automatic position," remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the "on" position, the generator set manually starts. The "off" position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on a common control and monitoring panel mounted on the generator set. Mounting method isolates the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls: Include the following:
  - 1. AC voltmeter.
  - 2. AC ammeter.
  - 3. AC frequency meter.
  - 4. DC voltmeter (alternator battery charging).
  - 5. Engine-coolant temperature gage.
  - 6. Engine lubricating-oil pressure gage.
  - 7. Running-time meter.
  - 8. Ammeter-voltmeter, phase-selector switch (es).
  - 9. Generator-voltage adjusting rheostat.
  - 10. Start-stop switch.
  - 11. Overspeed shutdown device.
  - 12. Coolant high-temperature shutdown device.
  - 13. Coolant low-level shutdown device.
  - 14. Oil low-pressure shutdown device.
  - 15. Fuel tank derangement alarm.
  - 16. Fuel tank high-level shutdown of fuel supply alarm.
  - 17. Generator overload.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.
- E. Remote Emergency-Stop Switch: Flush wall-mounted, unless otherwise indicated and prominently labeled. Push button is protected from accidental operation.
- F. Remote Alarm Annunciator: Comply with NFPA 99. Labeled LEDs identify each alarm event. Common audible signal sounds for alarm conditions. Silencing switch in face of panel silences signal without altering visual indication, connect so that after alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface or flush-mounting type to suit mounting conditions indicated. Locate at Nurse's Station as shown on drawings or as required by NFPA.

## 2.11 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
  - 1. Tripping Characteristic: Designed specifically for generator protection.
  - 2. Trip Rating: Matched to generator rating.
  - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  - 4. Mounting: Adjacent to or integrated with control and monitoring panel.
  - 5. Auxiliary contact(s): NC dry contacts which mimic generator circuit breaker position.

**2.12 GENERATOR, EXCITER, AND VOLTAGE REGULATOR**

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction prevents mechanical, electrical, and thermal damage due to vibration, over speed up to 125% of rating, and heat during operation at 110% of rated capacity.
- F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.
- G. Enclosure: Drip proof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
  - 1. Adjusting rheostat on control and monitoring panel provides plus or minus 5% adjustment of output- voltage operating band.
- J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- L. Sub transient Reactance: 12%, maximum.

**2.13 \*OUTDOOR GENERATOR-SET ENCLOSURE (SOUND ATTENUATED)**

- A. Description: Vandal-resistant, weatherproof steel or aluminum housing, non-hydroscopic sound attenuating material, UL 2200, wind resistant to at least 150 mph. Multiple doors are lockable and provide adequate access to components requiring maintenance. Instruments and control are mounted within enclosure. Sound attenuated to 70-73 dBA @ 7 meters.
- B. Muffler Location: Internal to enclosure.
- C. Engine Cooling Airflow through Enclosure: Adequate to maintain temperature rise of system components within required limits when unit operates at 110% of rated load for two-hours with ambient temperature at top of range specified in system service conditions.
- D. Louvers: Enclosed motor operated engine cooling air inlet and discharge. Louvers prevent entry of rain and snow.
- E. Automatic Dampers: At engine cooling air inlet and discharge. Dampers are closed to reduce enclosure heat loss in cold weather when unit is not operating.
- F. Maintenance Receptacle: 120V 20 Amp receptacle mounted on exterior of enclosure.
- G. Pre-wired AC Distribution: 100 Amp, 120/240 Volt, 1Ø load center for all AC power features (battery charger, battery heater, block heater, receptacles, etc.)

**2.14 FACTORY TEST**

- A. Provide a factory test and certified report of the test. Report shall substantiate the unit's full power rating, stability, voltage, and frequency regulation.
- B. Provide with the test report complete operating instructions and maintenance manuals with parts list and maintenance recommendations.

**2.15 LOAD BANK**

- A. Description: Permanent, outdoor, weatherproof, remote-controlled, forced-air-cooled, resistive, and reactive unit capable of providing a balanced three-phase, delta-connected



load to generator set at 100% rated-system capacity, at 80 percent power factor, lagging. Unit may be composed of separate resistive and reactive load banks controlled by a common control panel. Unit is capable of selective control of load in 25 percent steps with minimum step changes of approximately 5% and 10% available.

- B. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and steel supports. Elements are double insulated and designed for repetitive on-off cycling. Elements are mounted in removable aluminized-steel heater cases.
- C. Reactive Load Elements: Epoxy-encapsulated reactor coils.
- D. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor provides uniform cooling airflow through load elements. Airflow and coil operating current are such that, at maximum load, with ambient temperature at the upper end of the specified range, load-bank elements operate at not more than 50% of maximum continuous temperature rating of the resistance wire.
- E. Load Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors are located within a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.
- F. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.
- G. Load-Bank Enclosures: NEMA 250, Type 3R, complying with NEMA ICS 6. Louvers at cooling air intake and discharge openings prevent entry of rain and snow. Openings for airflow are screened with 1/2" (13mm) square galvanized steel mesh. Reactive load bank includes automatic shutters at air intake and discharge.
- H. Protective Devices: Power input circuits to load banks are fused, and fuses are selected to coordinate with generator circuit breaker. Fuse blocks are located within contactor enclosure. Cooling airflow and over temperature sensors automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors disconnect load power, control, and heater circuits. Fan motor is separately protected by overload and short-circuit devices. Short-circuit devices are non-interchangeable fuses with 200,000 Amp interrupting capacity.
- I. Remote-Control Panel: Separate from load bank in a NEMA 250, Type 1 enclosure. Includes a control power switch and pilot light, and switches controlling groups of load elements.
- J. Control Sequence: Control panel may be preset for adjustable single step loading of generator during automatic exercising.

## 2.16 OTHER PRODUCTS

- A. Wiring system
  - 1. Refer to Section 26 27 00 for product information.
- B. Emergency Lighting
  - 1. Refer to Section 26 50 00 for product information.
- C. Fire Alarm System
  - 1. Refer to Section 28 30 00 for product information.
- D. Nurse Call System
  - 1. Refer to Section 26 36 23 for product information.
- E. Automatic Transfer Switches
  - Refer to Section 26 36 23 for product information.

## PART 3 - EXECUTION

**3.01 WIRING**

- A. Prior to acceptance of portable generator set, perform 100% rated output test at construction site with temporary load bank of appropriate size. Upon acceptance, make temporary connections as required.
- B. All wiring shall be in galvanized steel conduit and shall be installed in accordance with the manufacturers wiring diagrams.
- C. Wiring shall be in accordance with the NEC and the local authorities having jurisdiction.
- D. Connections to the generator shall be made flexible.
- E. Provide control wiring from all automatic transfer switches (including those provided under separate contract, such as fire pump controllers) to the generator.
- F. Provide power to all generator required auxiliary systems (such as, block heater, battery charger, battery heater, etc.) as indicated on the drawings or from the panel as directed by the owner/architect/engineer.

**3.02 GENERATOR**

- A. The generator shall be mounted on a concrete slab, minimum 0'-6" thick reinforced concrete. Pad is to extend 0'-6" beyond the footprint of the generator in each direction.
- B. Arrange for fuel installation of diesel fuel.
- C. Install a 1" static deflection vibration isolation.
- D. Install critical muffler and muffler tailpipe to the exterior. Muffler/tailpipe shall be flexibly coupled to the engine with a stainless-steel exhaust connector.

**3.03 TESTING**

- A. Perform field quality control testing under the supervision of the manufacturer's factory authorized service Representative.
- B. Furnish load bank of adequate size to test generator at 100% rated output prior to connection to building emergency power system.
- C. Perform tests as recommended by manufacturer.
- D. Coordinate tests with tests of automatic transfer switches and run them concurrently.
- E. Correct deficiencies identified by tests and retest until requirements are met.

**3.04 DEMONSTRATION**

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the emergency generator set.
- B. Coordinate this training with that of the transfer switches.
- C. The minimum training session is to be eight hours.

END OF SECTION

**SECTION 26 36 23 - AUTOMATIC TRANSFER SWITCH****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 26 00 00 for requirements which are applicable to this section.
- B. Refer to National Electrical Code.
- C. Refer to NEMA, UL and IEEE Standards.
- D. Refer to NFPA 110.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish, install, and place into operation automatic transfer switches with number of poles, amperage, voltage and withstand ratings as indicated on the plans and specified herein.
- B. Provide necessary controls between the automatic transfer switch and the power system to insure proper operation and power transfer.

**1.03 SUBMITTALS**

- A. Submit shop drawings of switch and accessories.
- B. Submit manufacturer's data sheets of equipment.
- C. Submit manufacturer's certificates of conformance with applicable codes.
- D. Submit wiring diagrams of switch and accessories.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install systems and equipment in accordance with NEC.
- C. Provide adequate supervision of labor force to see that installations are correct.

**PART 2 - PRODUCTS****2.01 AUTOMATIC TRANSFER SWITCH**

- A. Furnish and install switch system(s) with number of poles, amperage, voltage and withstand ratings as shown on the plans. The system shall comply with the latest requirements of Underwriters' Laboratories UL Std. 1008 and NEMA ICS10-1993, (formerly Std. ICS 2-447). In addition, the switch performance must meet or exceed the following requirements and, if so requested, be verified by certified laboratory test data: Temperature Rise, withstand, dielectric and transient withstand tests.
- B. Automatic transfer switch systems shall meet all the requirements of the specification and as a minimum be equal to an ASCO 300 Series.

- C. Acceptable Manufacturers: ASCO, Russelectric, Zenith, Kohler (Detroit Diesel), ONAN, or Caterpillar.

## 2.02 AUTOMATIC TRANSFER SWITCH OPERATION

- A. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be one-sixth of a second or less. Mechanical locking in each position shall be accomplished without the aid of permanent magnets, latching solenoids or power operators. Operation shall be true double throw with no possibility of a neutral position. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and power conductors. A manual operating handle shall be provided for maintenance purposes.
- B. The automatic transfer switch shall include a separately mounted control panel with adjustable solid-state sensing and timing functions. The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and with inherent digital serial communications capability. The control module shall be connected to the transfer switch by an interconnection wiring harness. The harness shall include a keyed disconnect plug to enable the control module to be disconnected from the transfer switch for routine maintenance.
- C. Where neutral conductors must be switched, the ATS shall be provided with fully rated neutral transfer contacts. When neutral conductors are to be solidly connected, a neutral terminal plate with fully rated AL-CU pressure connectors shall be provided.
- D. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.
- E. Provide strip heater with thermostat for Type 3R enclosure requirements.
- F. Controller shall be flush-mounted display with LED indicators for switch position and source acceptability. It shall also include test and time delay bypass switches.

## 2.03 STANDARD ACCESSORIES

- A. 1-3 second adjustable transfer time delay. (1 second factory set)
- B. 0-5 minute adjustable time delay on transfer to emergency. Controls loading of generator. (0 minutes factory set)
- C. 0-30 minute adjustable time delay on retransfer to normal. Time delay is automatically bypassed if emergency source fails. (30 minutes factory set)
- D. Toggle switch- Manually bypasses time delay on retransfer.
- E. 5 minute cool-down time delay on engine shutdown.
- F. Adjustable close differential voltage sensing of all normal source phases.
  1. Pickup voltage 85-100% (Factory set - 95% of nominal voltage)
  2. Dropout voltage 70-90% (Factory set - 85% of nominal voltage)
- G. Adjustable independent emergency voltage and frequency sensing.
  1. Pickup voltage 85-100% (Factory set - 90% of nominal voltage)
  2. Pickup frequency 90-100% (Factory set - 95% of nominal frequency)
- H. All settings field adjustable with no special tools required.
- I. Test switch - Simulates failure of normal source. (Momentary type)
- J. Gold plated engine starting contacts. (10-ampere SPDT)
- K. Pilot lights- Indicate switch position. Auxiliary contacts-1-N/C and 1-N/O on "Normal" (10 amps,

- 480 VAC.)
- L. Microprocessor- Output terminals shall be provided to signal the actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.
  - M. An engine generator exerciser shall be provided where so indicated on the plans. The exercising timer shall be built-in to the ATS module and shall include a selector switch to select exercise with or without load transfer. Exercise setting shall be set by pushbutton and a digital display shall be provided to indicate settings.
  - N. An in-phase monitor shall be inherently built into the controls. The monitor shall control transfer/retransfer operation between live sources so that closure on the alternate source will occur only when the two sources are within 15 electrical degrees maximum so that inrush currents do not exceed normal starting currents. The monitor shall function over a frequency difference range of up to +2.0 Hz with maximum operating transfer time of one-sixth of a second. If the voltage of the load-carrying source drops below 70%, the in-phase function shall be automatically bypassed. The monitor shall not require inter-wiring with the generator controls, or active control of the governor.
  - O. Switched neutrals (shown as 4 pole switches on the drawings) shall have fully rated neutral transfer contacts.

#### 2.04 ASCO OPTIONAL ACCESSORY NUMBER - 72A

- A. Serial communications: The control module shall include provisions for future serial communications capability. Serial communication shall provide for remote: position indication, testing, source availability (as defined by the actual pick-up and drop-out settings), and indication of any time delay currently in operation of all Automatic Transfer Switch(es).

#### 2.05 ASCO OPTIONAL ACCESSORY NUMBER 44G

- A. Enclosure Heater - a 125 W enclosure heater with transformer and thermostat, adjustable from 30°F to 140°F.

#### 2.06 WITHSTAND AND CLOSING RATINGS

- A. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of over-current protection shown on the plans. WCR ATS ratings as be as follows when used with specific circuit breakers:

ATS Size	Withstand & Closing Rating MCCB	W/CLF
30	22,000A	100,000
70 - 200	22,000A	200,000
230	22,000A	100,000
260 - 400	42,000A	200,000
600 - 1200	65,000A	200,000
1600 - 2000	85,000A	200,000
2600 - 3000	100,000A	200,000

### PART 3 - EXECUTION

### 3.01 AUTOMATIC TRANSFER SWITCHES

- A. Furnish and install automatic transfer switches on all motors which do not have integral equipment transfer switches.
- B. Furnish and install automatic transfer switches where indicated on the drawings.
- C. Automatic transfer switches shall be installed to meet the area classification as to standard, hazardous, rainproof, etc.
- D. Automatic transfer switches shall be installed securely to building structure or be provided with supplemental support steel such as angle iron or unistrut when required to locate on other than building structure.
- E. All automatic transfer switches shall be grounded.
- F. Furnish and install control wiring from each automatic transfer switch to the generator.
- G. Power transfer shall be as follows:
  - 1. Life Safety ATS: Within 10 seconds of power failure.
  - 2. Standby power ATS: Staggered from one minute to five minutes past the power failure to ensure generator accepts the loads. Coordinate ATS transfer with owner (i.e., ATS for HVAC may be more critical than UPS transfer).
  - 3. Fire Pump: Within ten seconds of power failure.

### 3.02 TESTING

- A. Perform field quality control testing under the supervision of the manufacturer's factory authorized service representative. Coordinate testing with that of emergency generator testing.

### 3.03 DEMONSTRATION

- A. Engage a factory authorized service representative to train owner's personnel to adjust, operate, and maintain transfer switches. Coordinate training with generator equipment training.

END OF SECTION

**SECTION 26 43 13 - SURGE SUPPRESSION****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for requirements which are applicable to this section.
- B. Refer to National Electrical Code.
- C. Refer to UL, ANSI, IEEE, and NEMA Standards.
- D. Refer to Computer Business Manufacturer's Association (CBEMA), Information Technology Industry Council (ITIC) and International Electrotechnical Commission (IEC) for clamping voltage tolerance guidelines for sensitive equipment.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to install and place into operation surge suppression where indicated on drawings and/or specifications.

**1.03 SUBMITTALS**

- A. Submit shop drawings, product data, and manufacturer's installation instructions.
- B. The surge suppression submittal shall also include:
  - 1. Dimensional drawing of each suppressor type indicating mounting arrangements.
  - 2. UL 1449 Third Edition documentation (SCCR, VPR, MCOV, I-n).
- C. All Surge Protective Devices shall be of the same manufacturer.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install equipment with accordance with National Electrical Code.
- C. Provide adequate supervision of labor force to see that installations are correct.
- D. Surge protection devices shall be manufactured in the USA, by a company normally engaged in the design and manufacture of such devices for at least ten years.

**1.05 SAFETY AGENCY APPROVALS**

- A. Suppressers shall be listed in accordance with UL 1449 3rd Edition documentation, standard for safety, surge protective devices and meet requirements in UL 1283 for electromagnetic interference filters.

**PART 2 - PRODUCTS****2.01 SERVICE ENTRANCE**

- A. Surge protection devices shall be installed at all service entrances of each building and/ or as shown on the riser diagram.
- B. Suppressers shall be tested per ANSI/IEEE C62.45.
- C. Wye systems shall have suppression elements between each phase conductor and the system neutral, between each phase conductor and the system ground and between the neutral conductor and ground (true 10-mode protection).
- D. Each phase shall have a minimum of two modules. The surge modules shall be fused at a minimum rating of 30 Amp. Modules and fuses shall be field replaceable. Fuses shall be surge suppression fuses. (Ferraz Shawmut VPS Series)
- E. Visible indication of proper suppresser connection and operation shall be provided. The indicator shall consist of an LED array. No single LED or neon indicators will be used.
- F. The surge protection device shall be equipped with an audible alarm that shall actuate when any part of the surge circuitry has been damaged. A silence button shall be provided with the alarm.
- G. The suppressor shall exhibit Sine Wave Tracking circuitry and shall provide high frequency noise filtering up to 50dB attenuation (100 kHz-100 MHz).
- H. Suppressors shall meet or exceed the following criteria:
  - 1. Minimum single impulse current rating (L-N + L-G): 160,000 Amp per phase, 80 kA per mode.
  - 2. Incorporate hybrid circuitry.
  - 3. UL 1449 3rd Edition voltage protection ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-L	L-L	MCOV
120/208	800	800	800	1200	150
277/480	1200	1200	1200	2000	320

- I. Suppressors shall exhibit redundant protection for each phase and consist of solid-state components and shall operate bi-directionally.
- J. Suppressor shall be equipped with a surge counter with a reset and battery backup.
- K. Suppressor short circuit current rating shall meet or exceed that of the service panelboard.
- L. Total Protection Solutions (Joslyn) Surge Track ST160 or approved equivalent by Advanced Protection Technologies, Inc., Siemens, ABB Group, Eaton, Square D, or LEA International.

## 2.02 SECONDARY DISTRIBUTION INTEGRATED SUPPRESSION PANELS:

- A. Surge Protective Devices shall be installed in secondary distribution panels as shown on the riser diagram.
- B. Suppressor shall be tested per ANSI/IEEE C62.45.
- C. Wye systems shall have suppression elements between each phase conductor and the system neutral, between each phase conductor and the system ground and between the neutral conductor and ground (true 10-mode protection).
- D. Visible indication of proper suppressor connection and operation shall be provided.
- E. The surge protective device shall be equipped with an audible alarm that shall actuate when any part of the surge circuitry has been damaged. A silence button shall be provided with the alarm.
- F. The suppressor shall exhibit Sine Wave Tracking circuitry. The surge suppressor shall have suppression circuitry that is field replaceable without disturbing the conduit or enclosure.
- G. Suppressors shall meet or exceed the following criteria:
  - 1. Minimum single impulse current rating (L-N + L-G): 80,000 amperes per phase, 40kA per mode.



2. UL Clamping voltage shall not exceed the following:

VOLTAGE	L-N	L-G	N-L	L-L	MCOV
120/208	800	800	800	1200	150
277/480	1200	1200	1200	2000	320

- H. Suppressors shall consist of solid-state components and operate bi-directionally. The manufacturer of the surge panel shall offer either a surface or flush cover, as required by the job conditions.
- I. Suppressor short circuit current rating shall meet or exceed that of the panelboard.
- J. Total Protection Solutions (Joslyn) Surge Track ST80 or approved equivalent by Advanced Protection Technologies, Inc., LEA International, Siemens, GE, Eaton, or Square D.

### PART 3 - EXECUTION

#### 3.01 SERVICE ENTRANCE

- A. Install one primary suppressor at each utility service entrance. Follow manufacturer's installation instructions.
- B. Suppressor shall be installed on the load side of the service entrance.
- C. Conductors between suppressor and point of attachment shall be at least #6 AWG stranded copper conductor or larger. The conductors shall be kept as short and straight as possible. Lead length of connecting conductors shall be within 3'-0".
- D. Suppressor's ground shall be bonded to the service entrance ground.

#### 3.02 SECONDARY DISTRIBUTION PANELS

- A. Install one secondary suppressor at each distribution panel location or as indicated on the riser diagram. Follow manufacturer's installation instructions.
- B. Suppressor shall be installed on the service panel, per the manufacturer's installation instructions. Contractor shall install circuit breaker in panel to attached surge panel to electrical distribution system if necessary.
- C. Conductors between suppressor and point of attachment shall be at least #6 AWG stranded copper conductor or larger. The conductors shall be kept as short and straight as possible. The maximum length of connecting wiring shall not exceed 1'-6". Pre-wired suppressors with conductors smaller than #6 wire are not acceptable.
- D. Suppressor's ground shall be connected to the distribution panel ground.

#### 3.03 CERTIFIED TESTS

- A. The surge suppresser manufacturer shall provide certified test results on the actual product being shipped to the job site. The test results shall be certified by an officer or engineer of the company as being performed on the product after manufacture.
- B. The test conducted shall be per ANSI/IEEE C62.45. The units shall be tested in all modes listed in this specification.

#### 3.04 WARRANTY

- A. The surge suppresser shall warrant the surge protective devices and supporting components against defects in material and workmanship for a minimum period of five years.

3.05 TESTING

- A. Perform field quality control testing under the supervision of the manufacturer's factory authorized service representative.

3.06 DEMONSTRATION

- A. Engage a factory authorized service representative to train owner's personnel to adjust, operate, and maintain equipment.

END OF SECTION

**SECTION 26 50 00 - LIGHTING****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for other requirements of this Section.
- B. All work to conform to the NFPA 70 National Electrical Code.
- C. Provide interior lighting controls to meet the adopted IBC / IECC / ASHRAE 90.1 code. Refer to Specification Section 26 09 00 for additional requirements.
- D. Refer to standards of the Illuminating Engineering Society.
- E. All exit and emergency lighting shall comply with NFPA Life Safety Code 101, ADA, and other local codes as may apply.

**1.02 SCOPE**

- A. Furnish and install a complete and operating lighting system, including all luminaires, wiring, lamps, and 0-10V dimmable LED drivers.
- B. All lighting outlets shall have a luminaire. If a luminaire designation is missing, furnish and install a luminaire in similar use in the project.
- C. All luminaires shall have a home run. If these are omitted on the drawings the contractor shall allow for a home run to the nearest appropriate panel.
- D. All rooms are to be provided with lighting controls. Provide manual switch and code required control devices as appropriate. If controls are not indicated within a space, controls are to be provided for the space in a similar manner as adjacent or similar spaces.
- E. Provide exit and emergency lighting as required by Code in all spaces to meet requirements of the AHJ. Allow for ten additional luminaires to be installed where directed by the AHJ.

**1.03 MOUNTING**

- A. The contractor shall be responsible for selecting mounting arrangements of luminaires to suit the construction or ceiling types. Contractor or his agent shall review architectural drawings to establish ceiling types prior to preparing shop drawings for submission. It is NOT to be understood that the luminaire schedule accounts for the mounting types. Frequently ceiling types are changed after the luminaire schedule has been completed.
- B. Luminaires shall be mounted on structurally secure supports. The contractor shall provide miscellaneous steel supports to span between structural elements to provide a base of support for the luminaires at the locations shown on the drawings. Refer to architectural and structural drawings for locations of beams, joists, purlins, etc.
- C. Exterior luminaires shall be mounted with anchor bolts of suitable size secured into concrete bases. The mounting arrangement shall be capable of withstanding a continuous wind of 100 MPH with gales to 130 MPH. EPA of luminaire shall be rated with pole to provide required performance.

**1.04 APPROVALS**

- A. Furnish shop drawings and catalog cuts of all luminaires for review by the engineer prior to ordering.

- B. Provide samples of any luminaire or luminaires when requested by the owner, architect, or engineer.
- C. Provide a point-by-point lighting level calculation for parking areas, areas when requested by the engineer, and for high profile areas (i.e., main lobbies, atriums, pools, gymnasiums, etc.), when an alternate manufacturer or luminaire is being presented for approval. Calculation shall be provided by the manufacturer or the local manufacturer's representative. Footcandle levels are to be indicated at a maximum of 10'-0" intervals (exterior) or 5'-0" intervals (interior). A drawing is to be provided at the same scale as the contract documents.

## PART 2 - PRODUCTS

### 2.01 LUMINAIRE REQUIREMENTS

- A. Luminaires shall be complete with wiring, lamp holders, lamps, reflectors, glassware, canopies, shades, bases, pendants, etc.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Luminaires shall be wired with type AF luminaire wire.
- D. Plastic lenses shall not be used. Provide either virgin acrylic, high impact polycarbonate or tempered glass or as specified in the luminaire schedule. Lens thickness shall be a minimum of 1/8".
- E. Any exposed luminaire housing surface, trim frame, door frame and lens frame shall be free of light leaks either between luminaire components or between luminaire and adjacent surface.
- F. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.
- G. Hinged door closure frames shall operate smoothly and easily without binding when installed and latches shall function easily by finger action without the use of tools.
- H. Recessed luminaires installed in an insulated ceiling shall be listed for use in insulated ceilings.
- I. Luminaires in damp areas shall be gasketed, vapor tight, and fabricated with aluminum instead of steel. These luminaires shall have pressure clamping devices in lieu of latches.
- J. Luminaires located in other harsh environments are to be of suitable construction and finish for the intended environment in addition to the requirements listed in the Lighting Luminaire Schedule.
- K. All luminaire lenses shall, from the manufacturer, be shipped within a protective covering, i.e. plastic bag, paper wrapped, to prevent dust, dirt, smudges prior to final acceptance.
- L. Drivers shall be easily serviceable when installed and shall not be mounted to removable reflectors or wire way covers.
- M. Luminaires shall have a minimum CRI of 80 and a CCT of 3500 K.
- N. Luminaires shall have a rated lamp life of 50,000-hours to L70.
- O. Luminaires shall be dimmable from 100% to 10% of maximum output.

### 2.02 LED DRIVERS

- A. Shall be internal.
- B. Shall be designed for ten-year operational life.
- C. Shall be designed to withstand electrostatic discharges according to IEC 61000-4-2.
- D. Shall be furnished with poke-in wire trap connectors, color coded to ANSI standard C82.11.
- E. Shall operate from a line voltage range of 108-305-volts, 50/60 Hz.
- F. Input current shall have Total Harmonic Distortion (THD) of less than 20% with a power factor of

>.90% to comply with ANSI standard C82.11

- G. Shall meet UL 8750, UL 1012, and UL 1310 as applicable in NFPA compliant installations.
- H. Shall have no visible output change at  $\pm 10\%$  line voltage input.
- I. Shall have a Class A sound rating (inaudible at 27dBA ambient noise level).
- J. Shall have a universal input voltage (120-277V/ 50-60Hz).
- K. Shall be Underwriters Laboratories (UL) Listed (Class P) and CSA Certified where applicable and rated for use in air handling spaces.
- L. Shall carry a five-year warranty from the date of manufacture for operation at a case temperature of 75°C or less. When operated at a case temperature between 75°C and 85°C, the warranty shall be three years from the date of manufacture.

## 2.03 LED EQUIVILANT LAMPS

- A. LED: ENERGY STAR Certified, NRTL compliant, FM Global compliant. Recessed luminaires shall comply with NEMA LE4, CRI: 80, CCT: 3500 K. Lamps dimmable from 100% to 10% of maximum light output, 50,000-hour lamp rated life, internal driver must be UL Listed, dimmable with any standard dimmer switch, smooth, flicker-free dimming.
- B. Manufacturers; Philips, Feit, Sylvania, GE, Archipelago.
- C. Contractor is to coordinate lamp color for all luminaires. Lamp color is to be similar in all spaces.

## 2.04 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction. Refer to Luminaire Schedule on drawings.
- B. Internally lighted Signs:
  - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
  - 2. Self-Powered Exit Signs (Battery Type) Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80% of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

# PART 3 - EXECUTION

## 3.01 LUMINAIRES

- A. All recessed LED troffers (2' x 2', 2' x 4', and 1' x 4') and recessed luminaires weighing up to 20 lbs. are to be installed in grids with mounting clips and with grid secured at diagonal corners of luminaire

- to the building structure. (4' x 4') luminaires to be secured at four corners.
- B. Recessed luminaires between 20 and 50 pounds are to have, in addition to above, 12-gauge steel safety chains at opposite corners hung slack from the building structure. Luminaires above 50 pounds to be independently supported directly from the structure with approved hangers and angular sway bracing according to manufacturer's installation guidelines.
  - C. Surface mounted and pendant luminaires under 15 pounds can be supported directly from the outlet box when all of the following apply: screws pass through round holes and not key slots in the luminaire body, the outlet box is attached to a main ceiling runner, and the outlet box is supported vertically from the building structure.
  - D. Surface luminaires between 15 and 50 pounds shall be bolted to the ceiling independent of the outlet box. Luminaires over 50 pounds shall be secured to the building structure using a manufacturer's approved mounting method.
  - E. Luminaires to be set plumb.
  - F. Provide 6'-0" flexible leads on recessed luminaires to allow for easy removal.
  - G. Recessed luminaires shall be set with mounting frames.
  - H. Coordinate final location of all luminaires with other disciplines to avoid interferences and potential obstructions as the work progresses.
  - I. Luminaires used for temporary lighting during construction shall be removed, cleaned, and re-installed prior to acceptance of the lighting system.
  - J. Luminaires shall be cleaned and free of all dirt, dust, smudges, and surface imperfections just prior to final acceptance.
  - K. Luminaires which are recessed in a fire rated ceiling shall be provided with an enclosure around the luminaire which shall maintain the fire rating integrity of the ceiling system. The installation of the enclosure shall meet the requirements of the authority having jurisdiction. The luminaire shall be insulation rated for higher temperature operation.
  - L. All recessed or surface mounted luminaires on or in sloped ceilings shall have sloped ceiling adapters to allow for vertical light distribution.

### 3.02 SWITCHING

- A. Provide lighting control switch legs to wall switches for all luminaires except for those operated by integral switches.
- B. Provide 3-way or 4-way control where indicated and for rooms with more than one entrance.
- C. Provide a single time clock, contactors and relays as indicated on the drawings and as necessary for site lighting and parking lot lighting control.
- D. Provide interior lighting controls to meet IBC 2015/IECC 2015/ ASHRAE 90.1. Refer to Specification Section 26 09 00 for additional requirements.

END OF SECTION

**SECTION 26 60 00 - SERVICE AND DISTRIBUTION****PART 1 - GENERAL****1.01 ELECTRIC SERVICE**

- A. Primary electric service shall be provided by contractor from utility pole underground via pull hole at property line to transformer. Secondary shall be provided by contractor from transformer to building service entrance gear. Contractor shall furnish and install all work required by the utility company for service.
- B. Contractor shall coordinate his schedule with the utility for completion of the installation and energization of the services.
- C. Contractor shall provide metering conduit between current transformer and final location of meter as determined by the utility company.

**1.02 REFERENCE**

- A. Refer to Section 26 00 00 for additional requirements of this section.
- B. Refer to requirements of the National Electrical Code and the utility company.

**PART 2 - PRODUCTS****2.01 UNDERGROUND SERVICE**

- A. U. L. listed Schedule 40 PVC conduit underground encased in 2" of reinforced concrete. Reinforcement shall include 4" x 4" No. 4 wire mesh on top level of conduit.
- B. Seal both ends of conduits with duct seal.
- C. Coupling shall be watertight.
- D. All service conduits shall be encased in concrete envelope.

**2.02 SECONDARY SERVICE CABLE**

- A. Copper conductors, 75 degrees C, 600V, thermoplastic insulation and neoprene outer jacket, U. L. listed. Type THWN.
- B. Manufacturers: Triangle, General Cable, Southwire.

**2.03 TRANSFORMER VAULT**

- A. Precast transformer vault, 7 feet x 7 feet x 4 feet 6 inches deep as manufactured by Penn-Cast Products, or A.C. Miller Concrete Products. Must be approved by Utility Company.

**2.04 PRIMARY CABLE**

- A. 5 kV, 15 kV, or 35 kV cable shall be provided as directed by utility company. Acceptable manufacturers: American Wire and Cable Company, General Cable Company. Okenite

Company, or Prysmian Power Cable. Must be approved by Utility Company.

## 2.05 PRIMARY DUCT

- A. 5" duct as recommended by Utility Company.

## PART 3 - EXECUTION

### 3.01 SERVICE

- A. Underground excavation shall be open cut, trenching to appropriate depth.
- B. Conduit shall not rest on rock or boulders.
- C. Backfill in 12" layers and pneumatically tamp.
- D. Sod disturbed grass areas.
- E. Provide new concrete or asphalt walks, curbs, driveways to match adjacent and original surfaces.
- F. Provide a concrete encasement of service conduits from utility pole or transformer to the building.
- G. Primary cable and duct shall be installed from transformer location to utility pole as designated by Utility Company, by the Electrical Contractor.
- H. Provide 10' of slack in cable for Utility Company connections.

### 3.02 POWER WIRING

- A. Wire between motors, starters, disconnects and source.
- B. Verify proper motor rotation.
- C. Furnish and install weatherproof disconnects, as indicated.
- D. All panel feeders shall be run in EMT raceway system.
- E. All wiring to roof top units, fans, equipment, and HVAC equipment shall be installed completely between panels and disconnect switches, and motors.
- F. Disconnects shall be mounted adjacent to electrical and mechanical equipment. Indoor installations shall utilize NEMA 1 enclosures. Outdoor installations shall utilize NEMA 3R enclosures.

### 3.03 GROUNDING

- A. All electrical equipment and systems shall be grounded.
- B. Grounding system shall consist of a ground bus bar connected to a driven ground rod. Utilize ground type clamp fitting.
- C. All connections to conduit, equipment and devices shall be made with compression type connections.
- D. The grounding system shall comply with the NEC.
- E. All outside lighting fixtures and poles shall be grounded.
- F. All equipment and devices shall be grounded in accordance with the manufacturer's recommendations.
- G. The ground system shall have a resistance of 25 ohms or less in compliance with the NEC.
- H. Furnish a ground system test report at the completion of the work.
- I. Substation area grounding shall be in accordance with Utility Company standards.



END OF SECTION

**SECTION 27 05 28 – LOW VOLTAGE CONDUIT SYSTEM****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for requirements which are applicable to this section.

**1.02 WORK INCLUDED**

- A. Provide labor, material, and supervision necessary to install all service and distribution as outlined in this section.

**PART 2 - PRODUCTS****2.01 WALL BOXES - TELEPHONE**

- A. Single gang galvanized steel with single gang device ring and wall plates.
- B. Modular jack to accept phone system wiring with two RJ-11 connectors.

**2.02 WALL BOXES - DATA**

- A. Single gang galvanized steel with single gang device ring and wall plates.
- B. Face plate to accommodate data system wiring.

**2.03 WALL BOXES - TELEPHONE AND DATA**

- A. Double gang galvanized steel with steel divided raceway.
- B. Double face plate with modular RJ-11 jacks for telephone and 2 data outlet grommets.
- C. Two raceways to accessible ceiling space.

**2.04 WALL BOXES – CATV**

- A. Single gang galvanized steel with single gang device ring and wall plate.
- B. Face plate to accommodate "F" type connectors.

**2.05 CONDUIT**

- A. 3/4" EMT from boxes to accessible ceiling space.
- B. Two 4" conduits from backboard through building foundation to exterior of the building, with pull wires.
- C. Provide 4" conduit raceway from Demarcation Room to Auxiliary Rooms on each floor.

**2.06 PLYWOOD BACKBOARDS**

- A. Furnish and install 3/4" thick marine grade plywood backpanels of the size and location where indicated.
- B. Install as a minimum a standard quad outlet and an isolated ground outlet at each location.
- C. Install a ground bar and insulated ground cable back to the building electrical service entrance ground.

### **PART 3 - EXECUTION**

#### **3.01 CONDUIT SYSTEM**

- A. Provide and install where indicated for the device being installed.
- B. Provide pull wire in empty conduit.
- C. Provide ground for system.
- D. Provide 120 volt quad receptacle at telephone backboard.
- E. Provide a 3/4 " thick marine plywood telephone backboard where indicated for use by the Telephone Company for the mounting of equipment.

END OF SECTION

**DIVISION 26 - ELECTRICAL****SECTION 26 00 00 - STANDARD CONDITIONS FOR ELECTRICAL WORK****PART 1 - GENERAL****1.01 REGULATIONS, CODES, STANDARDS**

- A. Reference Codes, applicable sections of the following codes and standards shall be considered as binding to the work of this project:
- |       |   |
|-------|---|
| NEMA  | National Electrical Manufacturers' Association    |
| NEC   | National Electrical Code (NFPA 70) - 2017 Edition |
| NECA  | National Electrical Contractors' Association      |
| NEIS  | National Electrical Installation Standards        |
| EGSA  | Electrical Generating Systems Association         |
| IBC   | International Building Code                       |
| NFPA  | National Fire Protection Association              |
| IEEE  | Institute of Electrical and Electronics Engineers |
| UL    | Underwriter's Laboratories, Inc.                  |
| IES   | Illuminating Engineering Society                  |
| OSHA  | Occupational Safety and Health Administration     |
| ANSI  | American National Standards Institute             |
| ASTM  | American Society for Testing and Materials        |
| FM    | Factory Mutual                                    |
| IRI   | Industrial Risk Ensurers                          |
| ISO   | Insuring Services Office                          |
| IPCEA | Insulated Power Cable Engineers Assoc.            |
| ADA   | Americans with Disability Act                     |
| NETA  | International Electrical Testing Association      |
- B. All local codes are to be incorporated.
- C. The latest adopted codes and latest editions of standards shall be the basis of conformance.
- D. Obtain and pay for all permits and inspections, and any associated charges.
- E. Inspection Agency Certificate of Inspection to be provided at completion of the work. Inspection by Middle Department Inspection Agency, Inc., or other local inspection agency.
- F. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.
- G. Where the contract documents are more stringent but not in conflict with the applicable codes, the more stringent requirements shall be followed.

**1.02 SUBMITTALS**

- A. The procedure for submissions of shop drawings shall be as specified in Division 1, or as a minimum, as indicated below.
- B. Furnish submissions of shop drawings and samples of materials and equipment as indicated in these sections, on the drawings, or as directed by the architect/ engineer. Submissions will

- be made in a timely fashion such that adequate time exists to review the drawings, or material, and arrive at the site in accordance with the project schedule.
- C. Submissions will not be accepted with work defined as "By Others". Identify contractor by name and with his approval so indicated. Submissions are required prior to purchasing, fabrication, or installation of any material or equipment. Submissions shall be reviewed and certified by the submitting contractor that they are in accordance with the project documents.
  - D. When requested by the engineer, shop drawings shall be required to be submitted to designated agencies for review and approval prior to submission to the engineer.
  - E. Contractor shall arrange and pay for all tests and inspections specified herein or required by above agencies and furnish required certificate of inspection to owner.
  - F. Contractor shall provide performance test data and wiring diagrams of all electrical equipment.
  - G. Submissions shall include warranties by the manufacturer for equipment being provided. Submissions for commonly related items such as fixtures, trim, carriers, shall be combined in a single brochure clearly identifying all items being furnished.
  - H. Shop drawings and submittals shall be checked and stamped by the contractor before submitting. They shall conform to measurements made at the site, the contract requirements, and shall be coordinated with all other trades.
  - I. Specific models in catalog sheets must be identified as well as all options, voltages, phases, etc. identified to be clear as to what is being provided.
  - J. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/ travel/ access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.
  - K. To aid in the preparation of submittals or shop drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150.00 per hour billable to the contractor.

### 1.03 SUBSTITUTIONS

- A. Substitution of other than specified manufacturers shall not be allowed after bid date.
- B. Prior approval is required for other manufacturers. If the contractor wishes for alternate materials or equipment to be considered, he must submit information at least ten days prior to the bid date. If acceptable, an addendum will be issued allowing the contractor to utilize the approved alternate.
- C. Samples shall be provided when directed by the architect or engineer.
- D. If the contractor submits alternate equipment, manufacturers, systems, methods, or materials not specifically identified in the specifications, additional review and investigation time may be required by the engineer. If the engineer determines additional review time is required because of the substitution, then this will be a billable service provided by the engineer at the rate of \$150.00 per hour. Also billable will be any redesign time and revisions to drawings should they be necessary for incorporation into the work. Services will be billable to the contractor making such substitutions and will be payable prior to approval, or rejection.

- E. If the contractor elects to submit alternate equipment, manufacturers, systems, methods, or materials, not specifically identified in the drawings and specifications, it is the contractor's responsibility to coordinate the work with other trades and pay for any associated costs with the substitution or change.
- F. Contractor and manufacturers shall be responsible for all physical characteristics of the equipment and field verify with final locations, coordinate with floor plans, confirm service access, clearances, confirm equipment arrangements, electrical disconnect clearances, and pathways/travel/access to the final equipment installation locations. Submission of equipment shop drawing will be deemed evidence of compliance with this requirement. If no shop drawing is submitted, contractor shall be fully responsible for a complete installation and assumes all related costs that affects the contractor and other trades.

#### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and equipment in manufacturer's original cartons or on skids.
- B. Store materials in dry enclosure out of way of work progress.
- C. Protect equipment, fixtures, and lenses after placement.

#### 1.05 REFERENCE

- A. Requirements established within the portions of this Project Manual titled Division 1, General Requirements are collectively applicable to the work of this section.
- B. Instructions to Bidders, Special Conditions and Addenda as issued are part of this specification.
- C. Electrical drawings along with all other project drawings represent the work of this Division.
- D. Drawings, Contract, General Conditions and Supplementary Conditions form a part of this section, by reference thereto and shall have the same force and effect as if printed herewith in full. Failure to review these sections shall not relieve the Contractor of his responsibility to fully comply with the terms therein.

#### 1.06 WORK SUMMARY

- A. Provide labor, materials, equipment, and supervision necessary to install complete, operating electrical systems as indicated on the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the require work.
- B. Contractor shall provide all demolition necessary to remove, replace, repair, install new or modify existing work whether it be walls, floors, ceilings, structure, mechanical or electrical required to install his work. Contractor shall replace all work to leave in a finished condition. Pipe, conduit, ductwork, and wiring shall be cut back behind wall surfaces above ceilings and below floor levels so that a patch can be placed over the opening.
- C. All work shown on the drawings and not expressly mentioned in the specifications and all work specified but not shown on the drawings, but necessary for the proper execution of same shall be performed by the contractor. It is not the intent of the drawings and specifications to describe every feature and detail of the work.
- D. No additions to the contract amount will be approved for any materials, equipment, or labor to perform additional work unless it can be clearly shown to be beyond the scope and intent of the drawings and specifications.
- E. Provide roof penetrations for electrical work and all associated roof work.
- F. \* Provide 3 phase, 4 wire electrical service of the size as indicated on the drawings at 208Y/120 V with distribution to all equipment 208V, luminaires and general-purpose receptacles at 120V.
- G. Provide fire alarm system with battery backup, horns, strobes, pull stations, annunciator panel, duct

- detectors, and all associated controls and appurtenances.
- H. Provide exit and emergency luminaires throughout with emergency power supply in addition to normal power.
  - I. Provide power to HVAC and plumbing equipment as necessary to have complete, operating systems.
  - J. Provide luminaires throughout, with exterior luminaires at all egress doors.
  - K. Provide site luminaires for all parking areas, roadways, walkways, as well as security luminaires.
  - L. Provide telephone conduit system. Provide (2) CAT 3 plenum rated telephone cables from the telephone demarcation point to the fire alarm control panel for the auto dialer.
  - M. Provide Uninterruptible Power Supply System (UPS) with input filter, transformer, battery, and all associated controls and appurtenances.
  - N. Provide grounding system for facility in accordance with the NEC.
  - O. Provide addressable security system with battery back-up, intrusion detection sensors, signal equipment, system controls, alarm displays, alarm indicating devices, telephone auto dialer, and manual keypads to change system status, wiring methods, and appurtenances.
  - P. Provide communication/ sound system throughout complete with controller, receivers, CD/ tape decks, microphones, speakers, antennae, loudspeakers, equipment racks, wiring methods, and appurtenances.
  - Q. Base bid is to provide all primary cable, transformer coils, busways, switchboards, panelboards, and all feeders as copper conductors. Alternate bid is to provide all as aluminum conductors of equivalent current carrying capacity.
  - R. Provide code required signage (i.e., NEC 110.34, NEC 700.8, and 695.4 B3).
  - S. Provide third-party certification of all packaged systems by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399 as well as Pamphlet #70 and NEC Article 90.7.
  - T. Refer to Commissioning of Systems Specification for additional scope of work.

#### 1.07 SITE INSPECTION

- A. Visit site, inspect, and become aware of all conditions which may affect the work. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of a bid will be deemed evidence of being in compliance with this requirement. Contractor may not request additional costs for existing conditions which were evident from inspection of the site.
- C. Before ordering materials or commencing with any work, the contractor shall verify all measurements at the building. Coordination of equipment, materials, spaces, and dimensions are the responsibility of the contractor.

#### 1.08 UTILITY CONNECTION AND CHARGES

- A. The contractor shall be responsible for coordination of the work with the Electric Utility Company. Make all arrangements in a timely fashion for connection of the service.
- B. The Electrical Contractor shall be responsible for utility connection charges, meter charges, and other installation charges as may be applied by the local utility company.
- C. Contact the utility company during the bidding period for connection charges and include same with bid.
- D. Provide connections, terminations, handholes, manholes, pads, transformers, vaults, conduits, wiring, and all required materials and labor as may be required by the utility company to obtain service for the facility. Any costs for service work shall be included in the bid.

## 1.09 DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications are intended to be taken as a whole and each is to supplement the other. It is not intended that all work must be both shown on drawings and specified in the specifications.
- B. An item shown on the drawings and not indicated in the specifications is to be understood to be required for the project. An item specified and not shown on the drawings is to be understood to be required for the project.
- C. If there is a conflict between the drawings and specifications it is to be understood that the more strict or more expensive interpretation shall govern. Also, if a conflict exists between specification sections or between drawing plans and details, it is to be understood that the more strict or more expensive interpretation shall govern.
- D. The architect's or engineer's interpretation of the documents shall be binding upon the contractor. If a question arises, the contractor shall ask for an interpretation prior to bidding and an answer shall be issued as an addendum to all bidders.
- E. If a question arises after bidding the architect's and/ or engineer's interpretation shall govern.
- F. The drawings are generally diagrammatic and necessary field coordination and adjustment must be provided by the contractor prior to installation. Such deviations to the work to allow for coordination shall be kept to a minimum and any such deviations shall be at no extra cost.

## 1.10 MINIMUM INTEGRATED EQUIPMENT SHORT CIRCUIT RATING:

- A. Where the contract documents indicate secondary service from the utility Company (208/120V, 3 phase, or 480/277V, 3 phase) available short circuit currents including system motor contribution (amperes RMS symmetrical) at the line terminals of the UL service entrance labeled main distribution panelboard or switchboard, shall be in accordance with the following tabulation:

Service Minimum	Service Entrance	Panelboard Rating	Transformer Rating
kVA	%Z	208/ 120V	480/ 277V
75	1.5	14,500	10,000
112.5	1.5	22,000	10,000
125	1.5	29,000	13,000
225	1.5	43,000	19,000
300	1.5	58,000	25,000
500	1.5	96,000	42,000
750	5.5	42,200	18,000
1000	5.5	56,100	24,500
1500	5.5	85,000	37,000
2000	5.5		49,000
2500	5.5		51,000
3000	5.5		73,500

- B. The Integrated Equipment short circuit rating of the main distribution panel, or switchboard shall meet or exceed the tabulated minimum values. This shall be construed to mean that the equipment withstands capability (bus-bracing), and interrupting capacities of main and feeder devices, shall each meet or exceed the tabulated minimum values.
- C. Service transformer ratings shall be as indicated on the drawings. If said ratings are not indicated, the contractor shall contact the engineer and/ or utility company for clarification.
- D. The only deviations from this tabulation that are permissible shall be the results of a short circuit



study (if and as specified in Section 26 05 73 Power System Studies), or documented data from the utility company.

#### 1.11 PROGRESS SCHEDULE

- A. Provide a project schedule which shall show start, sequence of each type of work, milestone schedule, and completion of each type of work, with overall completion date.

#### 1.12 COST SCHEDULE

- A. Provide a detailed cost breakdown indicating labor and material amounts for various types of work.
- B. AIA forms are required for this submission.

#### 1.13 OFFICE

- A. The contractor shall set up his job office (desk) where directed by the owner.

#### 1.14 STORAGE

- A. Material shall be stored only where directed by the owner.

#### 1.15 SANITARY

- A. The contractor will at his own expense, provide and maintain in a sanitary condition, a portable chemical toilet.
- B. Toilet will be located where directed by the owner.

## **PART 2 - PRODUCTS**

#### 2.01 GENERAL

- A. All materials and equipment shall be new and in present production of major manufacturers.
- B. All materials and equipment shall be in conformance with accepted trade standards as a minimum. Where specifications exceed any minimum standard, the specifications shall govern.
- C. Reference of equipment in the singular shall be deemed to apply to as many such items as may be required to complete the work.
- D. The word "provide" means "furnish and install complete, tested, and adjusted as necessary with all accessories, wiring methods, switching, lenses, mounting hardware, cover plates, hangers and supports".

#### 2.02 FASTENERS AND SUPPORTS

- A. All work shall be securely fastened to building construction.
- B. Utilize toggle or machine bolts in hollow construction.
- C. Utilize machine screws for steel construction.
- D. Utilize expansion shields for masonry construction.
- E. Utilize lag bolts for wood construction.

- F. All fasteners shall be galvanized or plated with rustproof finish.
- G. Maximum load on fasteners shall be at a safety factor of 4:1 for a tested sample.

## 2.03 MOTOR STARTERS AND CONTACTORS

- A. Single-phase manual motor starters with overloads shall be provided under the electrical portion of the work for fractional horsepower motors up to ½ HP.
- B. Polyphase motor starters and motor starters above ½ HP shall be furnished under other portions of the work.
- C. The starters in A, or B above shall be installed under the electrical portion of the work.
- D. Polyphase starters shall be magnetic combination type, across-the-line, electrically operated, electrically held, three-pole assemblies, with arc-extinguishing characteristics, silver-to-silver renewable contacts, three-pole thermal bi-metallic, red "run" pilot light, individual phase protection, with overload heaters matched to motors installed and with four auxiliary contacts, Hand-Off-Auto switch, and control transformer.
- E. For single-phase motors above ½ HP provide magnetic combination, single-phase motor starters with overloads, non-fusible disconnect switch, red run pilot light, integral 120 volt control transformer with dual primary fusing, auxiliary contacts.
- F. Starters shall be as manufactured by G.E., Cutler Hammer, Siemens, Square D or Allen Bradley.
- G. Contactors shall be across-the-line, electrically operated, mechanically held three-pole assemblies for tungsten and ballast luminaire loads. Acceptable manufacturers: GE, Cutler Hammer, Siemens, Square D or Allen-Bradley.
- H. Manual motor starters without overloads in NEMA 1 enclosure equal to G. E. Type TC shall be used for the following load:
  - 1. 30 amperes or less, continuous.
  - 2. 1 HP or less at 120 volts
  - 3. 2 HP or less at 240 volts

## 2.04 MANUFACTURERS' NAMES

- A. Manufacturers' names are included herein to establish those suppliers who may provide products for this project subject to the requirements of the specifications. Although a manufacturer's name may appear as an acceptable supplier it is not understood that a standard product is acceptable. Products must also meet the technical, performance, and physical requirements of the project as well as being named in the specification. Any deviations from this must be acknowledged during the bid phase by the supplier, who shall be solely responsible for any and all costs associated with the application of their product(s) in the project.
- B. A design cannot be prepared which accommodates the installation of all suppliers and is not intended to do so. If certain modifications must be made to accommodate one particular supplier's equipment it shall be considered the contractor's responsibility to arrange for such accommodations and be financially responsible for same.

## PART 3 - EXECUTION

### 3.01 WELDING

- A. All electric power for arc welding shall be supplied by the contractor performing the work.

### 3.02 VEHICLES

- A. Vehicle access to the site will be as directed by the owner.

### 3.03 RUBBISH DISPOSAL

- A. Except for items or materials identified to be reused, salvaged, reinstalled, or otherwise indicated to remain property of the owner or tenant, demolished materials shall become the contractor's property and shall be removed, recycled, or disposed from the project site in an appropriate and legal manner.
- B. Burning of debris on the site shall not be permitted. All debris, refuse, and waste shall be removed from the premises at regular intervals. No accumulation shall be permitted.

### 3.04 WORKMANSHIP

- A. Maintain all public walks and access ways.
- B. Erect and maintain barricades, warning signs, and other protective means as may be directed by the owner for protection of all persons and property from injury or damage.
- C. Plug or cap open ends of piping systems and conduit.
- D. Stored materials shall be covered to prevent damage by inclement weather, sun, dust, or moisture.
- E. Protect all installed work until accepted in place by the owner. Protect luminaires.
- F. Do not install plates, covers, and other finished devices until masonry, tile, and painting operations are complete, or protect otherwise.
- G. Protect all existing or new work from operations which may cause damage such as hauling, welding, soldering, painting, insulation and covering.
- H. All devices and exposed raceways are to be plumb and true. All exposed raceways in finished areas are to be coordinated with the architect/engineer prior to installation.

### 3.05 SCAFFOLDING

- A. The contractor shall at his own expense, install, operate, protect, and maintain temporary services such as scaffolding, material hoists, access walks, etc., as may be required.

### 3.06 SITE UTILITIES

- A. The contractor may use the existing water and electric power for temporary construction needs.
- B. The owner will direct where these services may be tapped.
- C. Those services that are used during construction, but are to remain, shall be refurbished to a new condition before turning back over to the owner.

### 3.07 CLEAN-UP

- A. Remove all visible temporary tags or labels as well as any protective coverings and wrappings from fixtures and equipment.
- B. Remove all spots, stains, soil, paint, spackle, and other foreign matter from all finished work.
- C. Remove all trash and debris from the premises.

### 3.08 LUBRICATION

- A. Furnish and install and maintain all required lubrication of any equipment operated prior to acceptance by the owner. Lubrication shall be as recommended by the equipment manufacturer.
- B. Provide one year's supply of lubricants to owner at date of acceptance.
- C. Verify that required lubrication has taken place prior to any equipment start-up.

### 3.09 EQUIPMENT START UP

- A. Verify proper installation by manufacturer or his representative.
- B. Advise the architect and engineer two days prior to actual start up.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to the architect and engineer.

### 3.10 OPERATING INSTRUCTIONS AND MANUALS

- A. Properly and fully instruct owner's personnel in the operation and maintenance of all systems and equipment.
- B. Ensure that the owner's personnel are familiar with all operations to carry on required activities.
- C. Such installation shall be for each item of equipment and each system as a whole.
- D. Provide report that instruction has taken place. Include in the report the equipment and/ or systems instructed, date, contractor, owners' personnel, vendor, and that a full operating and maintenance manual has been reviewed.
- E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalog cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers, and emergency contacts. Three manuals shall be provided to owner.
- F. Submit manuals for review prior to operating instruction period. Manuals shall be 8 1/2" x 11" with hard cover, suitably bound.
- G. Provide to the owner any special tools necessary to operate any of the equipment.

### 3.11 PENETRATION SEALING

- A. All penetrations of Natatorium walls, fire walls, smoke walls, and floors shall be sealed around conduits and wiring to prevent the flow of gases or smoke.
- B. The sealant shall be foamed in place between the conduit or wiring and the adjacent walls and floors with Dow/ Corning RTV foam or Fire Stop Caulk.
- C. All penetrations through roof structure shall be coordinated with other trades to minimize the potential for water seepage and leakage through such penetrations.
- D. When electrical boxes are located on opposite side of a fire resistance rated wall assembly are within 2'-0" horizontally of each other, both devices are to be wrapped with Spec Seal Putty Pads as manufactured by Specified Technologies, Inc., or approved equivalent.

### 3.12 EQUIPMENT SETTING

- A. Furnish and install as a minimum, a 0'-4" high concrete pad beneath all floor-mounted equipment.
- B. Furnish and install as a minimum, spring vibration isolators under any equipment 10 HP and over and rubber-in-shear vibration isolation under all equipment less than 10 HP.
- C. Reinforce concrete with No. 4 rods 12'-0" on center, both ways.
- D. Pad to have 3/4" dowels into concrete at one per four square feet.

### 3.13 INSTALLATION MOUNTING HEIGHTS

- A. To be verified by Architect, but in general shall be as follows (top of device elevation above finished floor):

Lighting switches, controls:	3'-10"
Duplex receptacles:	1'-8"
Duplex receptacles over counters:	0'-8" above countertop
Telephone data wall plate and modular jack, desk phone:	1'-8"
Telephone, data wall plate and modular jack, wall phone:	3'-10"
Special outlets:	As required for equipment
Fire alarm annunciating devices:	85"
Fire alarm manual pull stations:	3'-10"
Clock receptacles:	As indicated on drawings.
CATV wall plates and modular jacks:	1'-8"
CATV wall plates and modular jacks mounted near ceiling:	Coordinate mounting height with Architect.
Thermostats (forward reach):	3'-10"
Thermostats (side reach):	3'-10"
Thermostats with lockable cover:	4'-6"

Requirements of the Americans with Disability Act and/or ANSI A117.1 shall be met.

- B. Structural and mechanical details shall be coordinated before roughing in.

### 3.14 COORDINATION

- A. Coordinate with work of other trades prior to installation.  
B. Arrange for minor variations for complete coordinated installation. Provide all necessary offsets to install the work and to provide clearances for other trades.

### 3.15 CUTTING AND PATCHING

- A. Provide for cutting and patching for all electrical work.  
B. Patching to be performed by tradesmen skilled in that particular trade.  
C. Contractor shall patch and repair any existing openings created by the demolition work in floors, walls, partitions, and ceilings not being reused for the new construction.

### 3.16 BALANCING AND TESTING

- A. Electrically balance connected loads in panels.  
B. The entire wiring system shall be tested to be free from grounds and faults.  
C. Identify all circuits and all phase wiring at terminations.

### 3.17 EQUIPMENT FURNISHED BY OTHERS

- A. This contractor shall make final electrical connections to equipment furnished by other contractors or the owner.

- B. Provide electrical service, and disconnect equipment as required by code to supply such equipment.

### 3.18 EXCAVATION, SHORING, PUMPING, BACKFILLING

- A. Perform all excavation required to install the work. Deposit excavated material as so not to create a slide hazard.
- B. Maintain excavations free of water.
- C. Backfill with clean material and pneumatically tamp in 0'-8" layers. Remove excess material, including rock, from site or as directed by the architect and engineer.
- D. Return to original conditions any areas disturbed for excavation.
- E. Install all work neatly, trim, and plumb with building lines.
- F. Install work in spaces allocated.
- G. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

### 3.19 RECESSES

- A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, grilles, and other equipment, and/ or devices which are to be recessed in walls.
- B. Make offsets or modifications as required to suite final locations.

### 3.20 LABELING

- A. All equipment panels, controls, safety switches, and devices shall be provided with permanent black laminated micarta white core labels with 3/8" high letters.
- B. This shall also apply to all controllers, remote start/ stop pushbuttons, equipment cabinets, and wherever directed by the architect and engineer.
- C. This shall not apply to individual room thermostats, and local light switches.

### 3.21 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the owner unless otherwise specified.
- B. Guarantee shall be extended for all non-operational periods due to failure within the guarantee period.

### 3.22 AS BUILT DRAWINGS

- A. At the completion of the work and prior to final payment, the contractor shall furnish a reproducible as-built drawing to the architect and engineer for approval. The drawings shall indicate all work installed and its actual size, and location and identify all systems installed with locations of concealed devices, conduit, piping and other equipment and complete wiring diagrams of all systems. If acceptable, the architect and engineer will submit the as-built drawings to the owner as record drawings. If not acceptable, the architect and engineer return the drawing to the contractor to make corrections as required. The contractor will resubmit for approval.
- B. The as-built drawings shall indicate measured dimensions of underground lines and other concealed work.
- C. To aid in the preparation of as-built drawings, the engineer can provide the electronic files for use by the contractor. The electronic files will be provided upon execution of the engineer's electronic file release contract prepared specifically for this project. The electronic files will be released in the

format used by the architect and engineer to design the project. If this file format is not compatible with the contractor's needs, additional charges for providing the changes to the requested file format may be necessary at \$150.00 per hour billable to the contractor.

### 3.23 SAMPLE CONSTRUCTION

- A. (One double and one single patient room) (one apartment) (one tenant space) shall be constructed and approved by the owner, architect/ engineer, and local code officials (electrical inspector or underwriter, building code official, fire marshal) before all other rooms are constructed.
- B. This room shall represent the standard against which all others will be constructed.
- C. Installation will include all units, ducts, piping, wiring, fixtures, devices, etc. which are required for complete rooms.

### 3.24 MAIN ELECTRICAL ROOM DRAWING

- A. Provide 3/8" = 1'-0" scale drawings of the Main Electrical Room indicating all electrical, mechanical, plumbing, telephone, security, fire alarm and life safety equipment to be installed within this room. Exact dimensions of equipment, pads, etc., are to be indicated. Show two cross sections at important points.
- B. Obtain information from other subs as appropriate.
- C. Submit for review and approval along with electrical equipment submittals. Equipment will not be approved prior to review of this drawing.

### 3.25 GENERAL ELEVATOR REQUIREMENTS

- A. The Electrical Contractor shall furnish and install an elevator safety switch sized to match the requirement of the elevator motor. Switch shall be located within the Elevator Machine Room on the strike side of the entrance doorway. The Electrical Contractor shall provide the branch circuit to the safety switch and make terminations between the switch and the elevator motor.
  - 1. For machine room less equipment, Switch shall be located within the Elevator Control Space.
- B. Furnish and install a 20 Amp dedicated circuit and disconnect switch for the elevator cab(s) lighting system. The disconnect switch is to be located within the Machine Room on the strike side of the entrance doorway. This circuit is to be ground fault protected.
  - 1. For machine room less equipment, Switch shall be located within the Elevator Control Space.
- C. Furnish and install a dedicated 20 Amp circuit for the elevator pit and Machine Room. Furnish and install GFCI receptacle and two, 2'-0" L LED strip luminaires located within the elevator pit (final quantity shall be as required to provide minimum illuminance per the elevator manufacturer). Pit devices and luminaire control are to be located adjacent to pit access.
  - 1. For machine room less equipment, GFCI device shall be located within the Elevator Control Space. Luminaire and control shall not be required within the Elevator Control Space.
- D. Furnish and install a telephone back box and conduit in the Elevator Machine Room for the elevator cab telephone circuit and local telephone jack.
  - 1. For machine room less equipment, telephone back box and conduit for the elevator cab telephone circuit and local telephone jack shall be located within the Elevator Control Space.
- E. Furnish and install smoke detectors for elevator recall at each elevator lobby when building is three stories or more. These automatic initiation devices are to be interlocked with elevator controller and building Fire Alarm Control Panel. Heat detectors are to be provided in the Machine Room and at the top and bottom of the elevator shaft.

1. For machine room less equipment, devices associated with the Machine Room shall not be required.
- F. When an automatic sprinkler system is present, automatic initiation devices for elevator power shut down are to be provided. These heat detectors are to be located within 2'-0" of all sprinkler heads in the Elevator Machine Room and Elevator Shaft. See Elevator Shunt Trip paragraph for further requirements.
  1. For machine room less equipment, devices associated with the Machine Room shall not be required.
- G. Furnish and install fire rated enclosures for the back boxes of any electrical devices recessed in the walls of the elevator equipment room or shaft. Walls are fire rated.
- H. Furnish and install two 20 Amp 120V circuits for sump pump and sump pump alarm. Coordinate with plumbing contractor.

### 3.26 ELEVATOR SHUNT TRIP (SPRINKLED BUILDING)

- A. The elevators are required to be provided with a shunt trip circuit breaker serving the equipment. All feeder circuit breakers (both on normal and emergency/standby power sources) are to be provided with the shunt trip device. The activation of the shunt trip is to be in the sequence described below.
  1. Upon activation of the fire alarm system by any manual or automatic means, including the smoke detectors required for recall, a signal is sent from the fire alarm control panel to the elevator controller to initiate recall of the elevator to the lowest non-fire floor. Upon activation of the 135°F heat detector located within 2'-0" of all sprinkler heads in either the Elevator Machine Room, the Elevator Pit or the top of the shaft, a signal is sent from the fire alarm control panel to immediately shunt-trip the power supply. This sequence will allow the elevator to be recalled to the lowest non-fire floor before the shunt trip is activated. The sprinkler heads in the Elevator Machine Room and elevator shaft are to be rated at 200°F, which will allow the shunt trip to activate prior to the sprinkler head.

### 3.27 WORK COMPLETION

- A. The contractor shall promptly correct work rejected by the engineer or failing to conform to the requirements of the contract documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed, or completed. Costs of correcting such rejected work, including additional testing and inspections and compensation for the engineer's services and expenses made necessary thereby, shall be at the contractor's expense.

### 3.28 REQUEST FOR INFORMATION (RFI) REQUIREMENTS

- A. All RFI's shall include the following information based on AIA Document G716:
  1. To, From, Project Name, Issue Date, RFI number in sequential order with all other trades, Requested Reply Date.
  2. Provide a description with specification and/or drawing references.
  3. Provide the senders recommendation including cost and/or schedule considerations.
  4. Provide receiver's reply space.
  5. Note an RFI reply is not an authorization to proceed with the work involving additional cost/time.

### 3.29 SHOP DRAWING REQUIREMENTS

- A. The following is a list of required shop drawings for this project.



<b>ELECTRICAL</b>	<b>DATE REC'D</b>	<b>ACTION</b>	<b>DATE REC'D</b>	<b>ACTION</b>
Basic Materials and Equipment (Section 26 05 00 and 26 27 00)				
Panelboards (Section 26 24 16)				
Safety Switches - (Section 26 28 16)				
Automatic Transfer Switch (Section 26 36 23)				
Surge Suppression (Section 26 43 13)				
Lighting (Section 26 50 00 and 26 09 00)				
Emergency Power System (Section 26 30 00)				
Fire Alarm and Detection Systems (Section 28 30 00)				
Low Voltage Systems (CCTV, Security, DATA, Phone Entry, etc.)				
As-Builts				
Warranties				
Maintenance Manuals				
Instructions				
Ground Test				

END OF SECTION

**SECTION 26 05 26 - GROUNDING AND BONDING SYSTEMS: GENERAL****PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.02 SUMMARY**

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of system described in other Sections.
- B. Related Sections include the following:
  - 1. 26 41 13 - LIGHTNING PROTECTION for additional grounding and bonding materials.

**1.03 SUBMITTALS**

- A. Product Data - For the following:
  - 1. Ground rods.
  - 2. Chemical rods.

**1.04 Qualification Data: For firms and persons specified in 1.05 QUALITY ASSURANCE Article.**

- A. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

**1.05 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in PART 3 - EXECUTION.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.
- C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Grounding Conductors, Cables, Connectors, and Rods:
    - a. Chance/ Hubbell
    - b. Copperweld Corp.
    - c. Erico Inc.; Electrical Products Group.
    - d. Framatome Connectors/Burndy Electrical
    - e. Galvan Industries, Inc.
    - f. Ideal Industries, Inc.
    - g. Kearney/ Cooper Power Systems.
    - h. Korns: C.C. Korns Co.; Division of Robroy Industries.
    - i. Lyncole XIT Grounding.
    - j. O-Z/Gedney Co.; a business of the EGS Electrical Group.\
    - k. Racor, Inc.; Division of Hubbell.
    - l. Salisbury: W.H. Salibury & Co.
    - m. Superior Grounding Systems, Inc.
    - n. Thomas & Betts, Electrical

**2.02 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Section 26 27 00.
- B. Material: Aluminum, copper-clad aluminum, and copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two band of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
1. Solid Conductors: ASTM B 3.
  2. Assembly of stranded Conductors: ASTM B8.
  3. Tinned Conductors: ASTM B33.
- H. Copper Bonding Conductors: As follows:
1. Bonding Cable: 28 kcmil, 14 strands of #17 AWG copper conductor, 1/4" Ø.
  2. Bonding Conductor: #4 or #6 AWG, stranded copper conductor.
  3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules: 1-5/8" wide and 1/16" thick.
  4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules: 1-5/8" wide and 1/16" thick.
- I. Aluminum Bonding Conductors: As follows:
1. Bonding Cable: 10 strands of #14 AWG aluminum conductor 1/4" Ø.
  2. Bonding Conductor: #4 or #6 AWG, stranded aluminum conductor.
  3. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules: 1-5/8" wide and 1/16" thick.
- J. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. #4 AWG aluminum, soft-drawn copper conductor.
  2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, cypress, or cedar.
- K. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

## 2.03 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per

## 2.04 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
- B. Ground Rods: Section type; copper-clad steel.
  1. Size: 5/8" Ø.
- C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a #4/0 bare conductor. Provide backfill material recommended by manufacturer.

# PART 3 - EXECUTION

## 3.01 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  1. Use insulated spacer; space 0'-1" from wall and support from wall 0'-6" above finished floor, unless otherwise indicated.
  2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
- F. Underground Grounding Conductors: Use tinned copper conductor, #2/0 AWG minimum. Bury at least 2'-0" below grade or bury 1'-0" above duct bank when installed as part of the duct bank.

## 3.02 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA

- 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
  - C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
    - 1. Feeders and branch circuits.
    - 2. Single-phase motor branch circuits.
    - 3. Three-phase motor branch circuits.
  - D. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  - E. Bond metal parts, motor frames, fittings, plumbing pipes, drains, metal conduit, metal surfaces within 5'-0", and all electrical devices and controls within 5'-0".
  - F. Motors shall be grounded by means of a grounding conductor in the same raceway with the motor feeder connected to the grounding bushing at the motor terminal box and the ground bus in the motor control center or to the incoming conduit grounding bushing of an individually mounted motor starter.

### 3.03 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

### 3.04 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For #8 AWG and larger, use pressure-type grounding lugs. #10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to

grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

1. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- F. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.05 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81. (Ensure that the test is performed with all ground-to-neutral bands broken. The grounding system must be completely isolated for the test to be valid.)
  3. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

**SECTION 26 09 00- LIGHTING CONTROLS****PART 1 - GENERAL****1.01 REFERENCE**

- A. This section includes manually operated, digital lighting controls with external signal source, relays, and control module.
- B. Refer to Section 26 00 00 for other requirements of this section.
- C. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.
- D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- F. Comply with NFPA 70 National Electrical Code (NEC).
- G. Refer to 26 27 00 for other lighting controls (switches, motion sensors, etc.).
- H. Provide interior lighting controls to meet the adopted IBC / IECC / ASHRAE 90.1 code.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install complete, operating, lighting control system specified herein.
- B. All rooms are to be provided with lighting controls. Provide manual switch and code required control devices as appropriate. If controls are not indicated within a space, controls are to be provided for the space in a similar manner as adjacent or similar spaces.

**1.03 SUBMITTALS**

- A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
  - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
  - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
  - 3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
- C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and system specified in other Sections.
  - 1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
  - 2. For networked controls, list network protocols and provide statements from

manufacturers that input and output devices meet inter-operability requirements of the network protocol.

3. Show equipment locations on floor plans of similar scale as contract documents.
- D. Field quality control test reports.
- E. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- F. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

#### 1.04 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
  1. Match components and interconnections for optimum performance of lighting control functions.
  2. Coordinate lighting controls with HVAC controls. When specifically indicated on lighting control system riser diagram, design display graphics showing building areas controlled; include the status of lighting controls in each area.
  3. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

#### 1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Failure of software input/output to execute switching or dimming commands.
    - b. Failure of modular relays to operate under manual or software commands.
    - c. Damage of electronic components due to transient voltage surges.
  2. Warranty Period: Two years from date of Substantial Completion.

#### 1.06 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

## PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Leviton Mfg. Company Inc.
  2. Hubbell Lighting Controls.
  3. Lithonia Lighting; Acuity Lighting Group, Inc.



4. Lutron Electronics Company, Inc.
5. ETC Lighting Control Systems.
6. Watt Stopper (The).

## 2.02 SYSTEM REQUIREMENTS

- A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.
- B. Performance Requirements: Manual switch operation, an internal timing and control unit and external sensors, send a signal to Programmable system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads.

## 2.03 CONTROL MODULE

- A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); Microprocessor based, solid-state, 365-day timing and control unit. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. An integral alphanumeric LCD or LED shall display menu-assisted programming and control.

## 2.04 POWER DISTRIBUTION COMPONENTS

- A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.
  1. Cabinet: Steel with hinged, locking door.
    - a. Barriers separate low-voltage and line-voltage components.
    - b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
    - c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
  2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
    - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
    - b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
    - c. Endurance: 50,000 cycles at rated capacity.
    - d. Mounting: Provision for easy removal and installation in relay cabinet.

## 2.05 MATERIALS

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 27 00 Section "BASIC MATERIALS."
- B. Class 1, 2, and 3 Control Cables: Multi-conductor cable with copper conductors as

- recommended by the manufacturer.
- C. Control wiring methods are to be per approved brand and part number of the lighting control manufacturer. No substitutions will be permitted.
- D. Manual Controllers: Comply with Division 26 27 00 Section "BASIC MATERIALS."

### **PART 3 - EXECUTION**

#### **3.01 WIRING INSTALLATION**

- A. Comply with NECA 1.
- B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- E. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

#### **3.02 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Test for circuit continuity.
  - 2. Verify that the control module features are operational.
  - 3. Check operation of local override controls.
  - 4. Test system diagnostics by simulating improper operation of several components.

#### **3.03 SOFTWARE INSTALLATION**

- A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

#### **3.04 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

#### **3.05 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel

to adjust, operate, and maintain lighting controls and software training for PC-based control systems.

END OF SECTION

**SECTION 26 24 16 - PANELBOARDS****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for additional requirements of this section.
- B. Refer to requirements of the National Electrical Code, UL, and the NFPA.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install panelboards as specified.

**1.03 SUBMITTALS**

- A. Submit manufacturers shop drawings of all equipment specified in this section.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturers' warranty requirements.

**PART 2 - PRODUCTS****2.01 DISTRIBUTION PANELBOARDS (MDP or PP)**

- A. **GENERAL** - Furnish and install distribution and power panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.
- B. **BUSSING ASSEMBLY AND TEMPERATURE RISE** - Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Bus shall be plated copper.
- C. **CIRCUIT BREAKERS** - Circuit breakers shall be equipped with individually insulated, braced, and protected connectors. Circuit breakers shall be flush with each other. Tripped indication shall be clearly shown. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Mechanical lugs are to be copper. For 480 V applications over 1000 Amp, the main breaker is to include electronic trip with LSIG characteristics.
- D. **\*\* EQUIPMENT SHORT CIRCUIT RATING (FULLY RATED)** - Each panelboard shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
- E. **CABINET** - Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters

shall be in accordance with UL Standard 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be removable. Fronts shall be of code gauge steel. Baked enamel finish electro-deposited over cleaned phosphatized steel.

- F. SAFETY BARRIERS - The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.
- G. UL LISTING - Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When required, panelboards shall be suitable for use as service equipment.
- H. NAMEPLATES - Provide laminated black phenolic resin with white core with 3/16 inch high engraved lettered nameplates for each circuit breaker to indicate the feeder, panelboard and equipment served. Mounted, with plated screws, adjacent to or on front of the breaker.
- I. Panelboards shall be by Square D, Siemens, Cutler Hammer or ABB Group.

## 2.02 LIGHTING & RECEPTACLE PANELS (LP or RP)

- A. GENERAL - Furnish and install circuit breaker lighting panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic molded case circuit breakers with frame and trip ratings as shown on the schedule.
- B. CIRCUIT BREAKERS - Shall be quick-make, quick-break, thermal-magnetic, trip indicating and have common trip on all multipole breakers. Trip indication shall be clearly shown by the breaker handle taking position between "ON" and "OFF" when the breaker is tripped. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V AC and carry the SWD marking. UL Class A ground fault circuit protection shall be provided on 120V AC branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker. A UL listed combination arc fault circuit interrupter (AFCI) shall be provided for all 120V, 15 or 20 Amp branch circuits as indicated on the plans or panelboard schedule or as required by the National Electrical Code. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for the branch circuit wiring. This breaker shall require no more panelboard branch circuit space than a conventional circuit breaker. Connections to the bus shall bolt-on.
- C. PANELBOARD BUS ASSEMBLY - Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single phase, three-wire panelboard bussing shall be such that any two adjacent single pole breakers are connected to opposite polarities in such a manner that two pole breakers can be installed in any location. Three phase, four-wire bussing shall be such that any three adjacent single pole breakers are individually connected to each of the three different phases in such a manner that two or three pole breakers can be installed at any location. All current carrying parts of the bus assemble shall be plated copper. Main's ratings shall be shown in the panelboard schedule or on the plans.
- D. WIRING TERMINALS - Terminals for feeder conductors to the panelboard mains and neutral

- shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type of conductor specified.
- E. CABINETS AND FRONTS - The panelboard bus assemble shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA and UL Standards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel.
  - F. Fronts shall include doors and have flush, cylinder tumbler-type locks with catches and spring-loaded stainless-steel door pulls. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Fronts shall be of code gauge steel.
  - G. \*\* EQUIPMENT SHORT CIRCUIT RATING (FULLY RATED) - Each panelboard shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
  - H. UL LISTING - Panelboards shall be listed by Underwriters Laboratories and bear the UL label. Equal panelboards may be provided by Square D, G.E., Cutler Hammer, or Siemens.
  - I. ELECTRONIC GRADE - Panels indicated to be electronic grade to have 200% rated neutrals, and an isolated ground bar in addition to the equipment ground bar.

### **PART 3 - EXECUTION**

#### **3.01 PANELS**

- A. Tops not to exceed 72 inches above floor.
- B. Provide labeling and complete directories.
- C. Ductwork or piping shall not pass over panels.
- D. Space shall be clear 36" in front of panel floor to structural slab or roof above.
- E. All conduit entering the panel shall have a screwed hub with an insulated bushing and no sharp edges.
- F. Wires shall be labeled and neatly arranged in the wiring gutters with wires cut to proper lengths and neatly racked.
- G. Electronic grade panels shall have feeder neutrals rated at 200% to maintain the UL listing of the panel and be provided with isolated ground conductor back to service entrance or feeder transformer.

#### **3.02 GROUNDING**

- A. All panels shall be grounded to the building equipment grounding system per NEC 408.40. Ground resistance shall not exceed NEC values.

END OF SECTION

**SECTION 26 27 00 - BASIC MATERIALS AND EQUIPMENT FOR METAL RACEWAY SYSTEMS****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for additional requirements of this section.
- B. Refer to NECA 1-2000 for general installation requirements.

**1.02 SUBMITTALS**

- A. Submit shop drawings and manufacturers catalog sheets of all specified items unless waived by the engineer.
- B. Submit switches and receptacles as a minimum.

**PART 2 - PRODUCTS****2.01 RIGID METAL CONDUIT (GRS)**

- A. Material: Steel, Zinc coated Federal Specification WW-C-581d, ANSI C801.
- B. Fittings: Malleable iron, Threaded.
- C. National Electrical Code; Article 344
- D. Application: Indoor, above ground, enamel coated, all occupancies not subject to severe corrosive influences.
- E. Manufacturer: Hubbell, Allied Tube and Conduit Corp. or approved equal.

**2.02 ELECTRICAL METALLIC TUBING (EMT)**

- A. Material: Galvanized steel, U.L. labeled, Federal Specification WWC-563 (latest revision), ANSI C80.3.
- B. Fittings: Threadless compression type for up to 1-1/4", set screw for 1-1/2" and larger. Installation in accordance with Article 358 of the National Electrical Code and U.L. general information card #FJMX.
- C. National Electrical Code; Article 358
- D. Application; Exposed and concealed work not subject to physical damage.
- E. Manufacturer: Hubbell, Allied Tube and Conduit Corp. or approved equal.

**2.03 FLEXIBLE METAL CONDUIT**

- A. Material: Hot dipped galvanized interlocking convolutions of steel tape in circular cross section. Federal Specification WW-C-566.
- B. Fittings: Hot dipped galvanized steel
- C. National Electrical Code; Article 360
- D. Application: All areas other than wet locations, hoistways, hazardous locations, below

ground, and areas with exposure to oil, gasoline, or other materials having an adverse effect on rubber.

- E. Manufacturer: Electri-flex Company Liqueflex Type BR, Hubbell, Allied Tube and Conduit Corp., AFC.

#### 2.04 RIGID NON-METALLIC CONDUIT (SCHEDULE 40 PVC)

- A. Material: U.L. 651, ANSI/ NEMA TC-2, Fed. Military Spec. WC-1094A, 90 deg. wire rated and sunlight resistant.
- B. Fittings: PVC, same as above.
- C. National Electrical Code; Article 352
- D. Application: In walls, floors, ceilings, wet locations, underground, and locations subject to severe corrosive influences.
- E. Manufacturer: Carlon Schedule 40 electrical conduit or approved equal.

#### 2.05 LIQUATITE FLEXIBLE METAL CONDUIT

- A. Material: Hot dipped galvanized interlocking convolutions of steel tape in circular cross section with PVC jacket.
- B. Fittings: Hot dipped galvanized steel.
- C. National Electrical Code Article 350 (LFMC)
- D. Application: All areas other than elevator hoistways, hazardous locations and where subject to physical damage.
- E. Manufacturer: Electrifiex Company Liqueflex Type LT, Hubbell, Allied Tube and Conduit Corp., AFC.

#### 2.06 CONDUCTORS

- A. Type; THHN, 98% conductivity copper, 600-volt, dry locations. Type THWN for wet locations. Conductors shall be U.L. listed.
- B. Equipment terminations for circuits rated 100 Amps or less (#14 AWG-#2 AWG) shall be rated 60°C (140°F). Equipment termination for circuits rated over 100 Amps (#1 AWG or larger) shall be rated 75°C (167°F). Refer to National Electrical Code for allowable exceptions. 90°C (194°F) rated conductors shall be used as indicated on the drawings or as indicated within these specifications.
- C. Solid copper conductors for #10 AWG and #12 AWG wire size. #8 AWG and larger shall be stranded copper.
- D. Separate green ground conductor for all circuits including branch, homerun, and feeders.
- E. All conductors shall be color coded as follows:
  - 120/ 208 Volt Systems
  - Phase A        Black
  - Phase B        Red
  - Phase C        Blue
  - Neutral Grey or Natural White
- F. Minimize size conductor shall be #12 AWG except that #14 AWG shall be used for control wiring. All circuit conductors shall be run in the same raceway system.
- G. A grounding conductor shall be provided to each electrical device in accordance with the National Electrical Code.
- H. Conductor sizes shall be as shown on drawings and/ or specified in this specification.
- I. Conductors shall not be installed in raceways until construction is advanced to allow conductors to be installed completely without damage to conductors and there is not



possibility of water or other contaminants entering the raceway system. Conductors shall be installed between convenient terminating points.

- J. An approved pulling compound shall be used to assist in pulling of conductors.
- K. Aluminum Alloy Conductors for Distribution Feeder Applications:
  - 1. Distribution feeder conductor's sizes #6 AWG to 1,000 Kcmil may be copper (Base Bid) or aluminum alloy (Alternate). Aluminum alloy conductors shall be compact standard conductors of a recognizable Aluminum Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy). AA-8000 series alloy conductor must be Alcan Cable Stabiloy or approved equal.
  - 2. Compliance with the elongation requirement per Table 10.1 of UL Standard 1581 for stranded AA-8000 series aluminum alloy conductors shall be determined on wires taken from the conductor after stranding by manufacturer.
  - 3. Insulation:
    - a. For use in raceways: Type XHHW-2, temperature rating 90o C.
    - b. For use in cable trays: Sizes #1/0 AWG and larger. Type XHHW-2, temperature rating 90°C and marked: "SUN RES", "VW-1", "GASOLINE AND OIL-RESISTANT II", "FOR CT USE".
- L. Manufacturer: Alpha Wire, Southwire, Tamaqua Cable, Triangle Wire & Cable, American Insulated Wire, BICC or General Cable.

## 2.07 JUNCTION BOXES

- A. Material: Galvanized steel, accessible.
- B. Manufacturer: Keystone, Hubbell, Penn Panel and Box Co.
- C. National Electrical Code; Article 314

## 2.08 OUTLET AND SWITCH BOXES

- A. Material: Galvanized steel with knockouts to suit raceway system.
- B. Manufacturer: Crouse Hinds Co., Steel City Div., Raco Inc., or approved equal.

## 2.09 WALL PLATES - THERMOSET PLASTIC - RESIDENTIAL GRADE

- A. Wall plates shall be standard size, thermoset plastic, residential grade.
- B. Plates shall be provided for all switches, receptacles, blanks, telephone, and special purpose outlets.
- C. Plates may be of modern design having rounded edges and corners and be complete with color-matched mounting screws.
- D. Plates must be of one design throughout the building and shall conform to UL, CSA, and NEMA standards.
- E. Engraving shall be done by plate manufacturer in accordance with the schedule.
- F. Acceptable Manufactures: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton

## 2.10 WALL PLATES - STAINLESS STEEL - TYPE 302 - CORROSIVE/ DAMPNESS/ FOOD SERVICE DUTY

- A. Wall plates shall be Pass and Seymour Sierra Series "S", Type 430 Stainless Steel, or "S-N" line Type 302 Stainless Steel or equal and will conform to UL and NEMA standards.
- B. Plates must be provided for all switches, receptacles, blanks, telephone, and special purpose outlets.
- C. Plates shall be of a modern design, having rounded edges and corners and be complete with

finish-matching mounting screws.

- D. Engraving shall be done by plate manufacturer in accordance with the schedule.
- E. Plates must be of one design throughout the building.
- F. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.

## 2.11 RECEPTACLES - STANDARD DUTY - COMMERCIAL/ SPECIFICATION GRADE

- A. All thermoplastic nylon body construction.
- B. Impact-resistant nylon face.
- C. One-piece triple-wipe brass power contact.
- D. Available with side and back wire capable of accepting #14 AWG-#10 AWG copper or copper-clad wire.
- E. Terminal compartments isolated from each other for positive conductor containment.
- F. Automatic grounding clip assures grounding to metallic boxes.
- G. Easily accessible break off tabs to facilitate split circuit wiring.
- H. Plated steel strap for corrosion resistance.
- I. Combination Phillips/ slotted head screws backed out for ease of installation.
- J. In compliance with UL 498.
- K. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- L. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- M. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- N. Leviton 5362/ 5361, 20 Amp, ivory, white, grey, black, brown, or almond.

## 2.12 RECEPTACLES - DECORA - SPECIFICATION GRADE

- A. Impact-resistant nylon face.
- B. One-piece, triple-wire brass power contacts.
- C. Corrosion resistant, plated, wrap-around steel strap locked into assembly to prohibit strap from bending away from body.
- D. Terminal compartments isolated from each other for positive conductor containment.
- E. Available in hospital grade and specification grade.
- F. Heavy-duty compact design for easier installation and long-lasting performance.
- G. Automatic grounding clip standard for positive ground to metal boxes.
- H. All devices fit standard #26 opening wall plate.
- I. Side and back wire accepts #14 AWG-#10 AWG.
- J. In compliance with UL 498.
- K. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- L. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- M. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- N. Leviton 16352, 20 amp, white, ivory, grey, black, or almond.

\* Those receptacles installed on the emergency system shall be clearly identifiable as distinct from normal system receptacles. (red)

## 2.13 GROUND FAULT CIRCUIT INTERRUPTING RECEPTACLES - STANDARD GRADE

- A. Side or screw pressure plate back wire with #14 AWG or #12 AWG solid or y-stranded

- copper wire.
- B. Extra-long strap.
- C. High-impact resistant thermoplastic construction.
- D. Ground screw with a wire guide channel.
- E. Dual-direction test and reset buttons.
- F. Line and load terminations supplied backed out, and ready to wire.
- G. Two back wire holes per terminal.
- H. Ultrasonic welding of face to back body.
- I. Mis-wire label applied to load terminals.
- J. GFCI Receptacle shall have SafeLock™ protection. If critical components are damaged and ground fault protection is lost or if mis-wired, power to receptacle is disconnected.
- K. Class A rated GFCI
- L. 1-1/2 HP rating on Motor Control GFCI switch (2081 series).
- M. Button colors match the device face.
- N. Supplied with matching wall plate.
- O. In compliance with UL-943, UL-498, UL-508.
- P. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- Q. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- R. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- S. Leviton 6898, 20 Amp, ivory, white, almond, or mahogany.

#### 2.14 TAMPER RESISTANT RECEPTACLES - COMMERCIAL

- A. Thermoplastic shutter for reliable tamper-resistant design.
- B. High-impact thermoplastic face and body.
- C. One-piece Brass Alloy grounding system.
- D. High performance copper alloy contacts assure the highest degree of blade retention.
- E. Ground contacts are encapsulated in thermoplastic body.
- F. Side or back wiring accepts #10 AWG, #12 AWG or #14 AWG copper.
- G. Eight hold back wiring for convenient feed thru wiring.
- H. In compliance with UL-498.
- I. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- J. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- K. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- L. Leviton 8300-SG, 20 Amp, ivory, white, grey, red, or brown.

#### 2.15 RECEPTACLES - FLOOR OUTLET

- A. Solid brass covered plate with matching flush fitting brass cap.
- B. Receptacle made of durable thermoplastic.
- C. Supplied with foam rubber gasket. O-ring and metal 18" cubic box.
- D. In compliance with UL 498.
- E. Pre-wired pigtail connectors that accommodate Federal Specification receptacles are approved. Must be crimped and welded terminal right-angle application within the connector.
- F. Receptacle shall be Federal Specification, WC896 compliant. Marking should be clearly identifiable on face or strap.
- G. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.

H. Leviton 5362/ 5361, 20 Amp, ivory, white, grey, black, brown, or almond.

## 2.16 TOGGLE SWITCHES - COMMERCIAL DUTY SPECIFICATION GRADE

- A. One-piece brass alloy contact arm.
- B. Thermoset body and cover for superior heat resistance.
- C. High strength polycarbonate toggle resists breaking and chipping under heavy abuse.
- D. Available with side wire or side and back wire models capable of accepting #14 AWG-#10 AWG copper or copper-clad wire.
- E. Cam designed for fast make with positive break action to minimize arcing and prolong switch life.
- F. Heavy-duty toggle bumpers for smooth and quiet operation.
- G. Oversized silver alloy contacts for longer dependable switch life.
- H. Plated steel strap for corrosion resistance.
- I. Combination Phillips/ slotted head screws backed out for ease of installation.
- J. In compliance with UL 20.
- K. Switches shall be Federal Specification WC596 compliant. Marking should be clearly identifiable on face or strap.
- L. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- M. Leviton CS120-2/ CS320-2/ CS420-2, 20 Amp, 120/ 277-volt, ivory, white, black, grey, or almond.

## 2.17 ROCKER SWITCHES - STANDARD GRADE

- A. Designer-style matte-finish rocker.
- B. High-impact resistant thermoplastic construction.
- C. Side or speed wire #14 AWG-#12 AWG.
- D. Smooth, quiet paddle action.
- E. Easy-access green hex head ground screw.
- F. Combination head screws.
- G. Framed rocker.
- H. In compliance with UL 20.
- I. Switches shall be Federal Specification WC596 compliant. Marking should be clearly identifiable on face or strap.
- J. Acceptable Manufacturers: Cooper Wiring Devices, Pass & Seymour, Hubbell, Leviton.
- K. Leviton 5601/ 5603/ 5604, 15 Amp, 120/ 277-volt, ivory, white, grey, almond, black, or brown.

## 2.18 AC MOTOR RATED SWITCH

- A. 30 Amp and/ or 40 Amp, 600-volt AC rated.
- B. Double pole or triple pole, single throw.
- C. UL 508, UL 94 (flammability) Listed.
- D. All molded parts are made of thermoplastic material to assure superior resistance to repeated impact, chemical degradation, extreme temperature fluctuations, tracking and arcing.
- E. Positive-contact design enhances fast make/ slow break mechanism by minimizing bounce and arcing upon contact closure and teasing upon separation.
- F. Free-travel toggle design protects closed contacts from accidental disengagement and contact teasing.
- G. Silver alloy contacts provide maximum conductivity and prolonged service life.
- H. Side and back wire terminal screws accept up to #10 AWG solid copper wire.

- I. For standard #8 AWG wire, remove terminal clamp and use ring terminal.
- J. Oversized #10, triple-combination, vibration-resistant terminal screws.
- K. Mounting yoke is made from nickel-plated brass for superior corrosion resistance.
- L. Insulating barriers between terminal screws provide isolation from each phase.
- M. Devices are permanently marked with catalog number, amperage, voltage, and horse-power ratings to assist with identification.
- N. Large toggle provides positive actuation, even when operated with gloved hand.
- O. Leviton MS302 (30 Amp, 2-Pole), MS 303 (30 Amp, 3-Pole), MS402 (40 Amp, 2-Pole) or MS403 (40 Amp, 3-Pole) or equivalent by Cooper Wiring Devices, Pass & Seymour, Hubbell.

## 2.19 DIMMER SWITCHES - DECORA SLIDE TYPE- SPECIFICATION GRADE

- A. Maximum ratings are for continuous full load.
- B. RFI suppression built in.
- C. Extra-heavy use models supplied with matching cover.
- D. Leviton 80800/ 80800-3/ 81000/ 81000-3/ 82000/ 82000-3, 800-watt, 1,000-watt, 2,000-watt-120-volt, 277-volt.
- E. Acceptable manufacturers: Cooper Wiring Devices, Pass & Seymour (Titan Series), Hubbell, Leviton.
- F. Full on bypass.
- G. Ivory, white, grey.
- H. Pre-set on-off switch.

## 2.20 SURFACE METAL RACEWAY AND WIREWAY

- A. Provide surface metal raceway system complete with all fittings, wiring, devices, etc. Surface raceway shall have baked enamel finish.
- B. These raceways are permitted only in dry locations where not subject to severe physical damage and must have metal not less than .04" thick. Do not use in hoistways and in any hazardous classified areas.
- C. The number, type, and size of conductors permitted in raceway shall be clearly marked on raceway or on shipping label.
- D. Splices and taps may be made providing raceway has an accessible removable cover.
- E. Wireway made of 14-gauge sheet metal forming a square trough with hinged cover and complete with couplings, 90 deg. elbows, tees, junction boxes, end plates, and supports may be used for surface wiring at load centers and other locations to the extent permitted by the National Electrical Code.
- F. Wireways in sizes 2-1/2" x 2-1/2" up to 12" x 12" square may be used; however, no conductor larger than that which the wireway is designed shall be installed therein. Wireway shall not contain more than thirty current carrying conductors at any cross-section and the sum of cross-sectional areas of all contained conductors at any cross-section shall not exceed 20% of the interior cross-sectional area of wireway.
- G. Wireways shall be treated with rust resistant primer and finished gray baked enamel.

## 2.21 MC CABLE

- A. Type: UL listed Type MC Cable with galvanized steel armor outer casing, color coded circuit conductors, insulated green grounding conductor. Each conductor insulated with thermoplastic insulation.
- B. National Electrical Code; Article 330, 518 and to comply with Federal Specification J-C-30B.
- C. Manufacturer: AFC Cable Systems MC, Alean Cable, BICC, Tamaqua Cable.

**2.22 FIRE ALARM MC CABLE**

- A. Type: UL listed Type MC Cable with galvanized steel armor outer casing, bare grounding conductor, color coded circuit conductors. Each conductor insulated with thermoplastic insulation.
- B. National Electrical Code; Article 760 and to comply with Federal Specification J-C-30B.
- C. Manufacturer: AFC Cable Systems Fire Alarm Cable or approved equal.

**2.23 RECESSED FLOOR BOX (CONCRETE FLOOR)**

- A. One, two, or three-gang box, cast iron for on or below grade, stamped steel for above grade.
- B. Fully adjustable before and after concrete pour.
- C. Shallow box as necessary.
- D. Removable dividers as necessary for multi-service applications.
- E. One, two, or three-gang cover plates; Carpet, tile, or brass as per application.
- F. Walker Wiremold Omnibox Multiservice Floor Box series.
- G. Acceptable Manufacturers: Wiremold, Hubbell, Thomas & Betts, Crouse Hinds.

**2.24 MULTISERVICE FLUSH POKE-THRU (4" FLOOR CORE)**

- A. Flush poke-thru with four Category 5 communications jacks and power.
- B. Communication adapter for protection of Category 5 cables.
- C. EMI/ RFI shielded divider, UL recognized.
- D. Manufacturers furnish 20 Amp isolated grounding specification grade duplex receptacle.
- E. Two-hour fire rating, UL Listed.
- F. Grommets for unused data jack parts (coordinate with data communications contractor).
- G. Wiremold 4ATCP4RBK Category 5 Flush Poke-thru.
- H. Acceptable Manufacturers: Wiremold, Hubbell, Thomas & Betts, approved equivalent.

**2.25 THREE SERVICE FURNITURE FEED POKE-THRU (3" FLOOR CORE)**

- A. Flush poke-thru for telephone, data, and power (up to ten wire) feeds to furniture partitions.
- B. Communication adapter for protection of communications cables.
- C. Up to four-hour UL Listed fire rating as indicated on drawings or specifications.
- D. Wiremold RC9AM2TC - 6A series flush poke-thru.
- E. Acceptable manufacturers: Wiremold, Hubbell, Thomas & Betts.

**2.26 MULTISERVICE RECESSED WALL BOX (FLAT SCREEN TVs, MONITORS)**

- A. Three-gang box, plastic housing, white finish. Flush mount appearance allows for snug-to-wall placement of flat-screen TV or monitor.
- B. Surge-protective duplex power outlet and up to 12 multimedia connections.
- C. Position either line voltage or low voltage devices in all three openings.
- D. Low voltage connectors offer both terminated and pull-through capability so plugs, and multimedia connections stay recessed behind the surface of the wall.
- E. Accepts standard TP wall plate.
- F. Legrand TV3WTVSSW. (ACTS standard)
- G. Acceptable Manufacturers: Hubbell, Thomas & Betts.

**2.27 INDOOR OCCUPANCY SENSORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Lighting.
  2. Leviton Mfg. Company Inc.
  3. Lithonia Lighting; Acuity Lighting Group, Inc.
  4. Novitas, Inc.
  5. RAB Lighting, Inc.
  6. Sensor Switch, Inc.
  7. TORK.
  8. Watt Stopper (The).
  9. Pass & Seymour
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of one to 15 minutes.
  2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  3. Relay Unit: Dry contacts rated for 20 Amp ballast load at 120-volt and 277-volt AC, for 13 Amp tungsten at 120-volt AC, and for 1 HP at 120-volt AC. Power supply to sensor shall be 24-volt DC, 150 mA, Class 2 power source as defined by NFPA 70.
  4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2" knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  6. Bypass Switch: Override the on function in case of sensor failure.
  7. Automatic Light-Level Sensor: Adjustable from 2-200 footcandles; keep lighting off when selected lighting level is present.
- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 0'-6" minimum movement of any portion of a human body that presents a target of not less than 36 square inches.
  2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1,000 square feet when mounted on an 8'-0" high ceiling.
  3. Detection Coverage (Corridor): Detect occupancy within 90'-0" when mounted on a 10'-0" high ceiling.
- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 1'-0" in either a horizontal or a vertical manner at an approximate speed of 1'-0" per second.
  2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 square feet. when mounted on an 8'-0" ceiling.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 square feet when mounted on an 8'-0" high ceiling.
  4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2,000 square feet when mounted on an 8'-0" high ceiling.

5. Detection Coverage (Corridor): Detect occupancy anywhere within 90'-0" when mounted on a 10'-0" high ceiling in a corridor not wider than 14'-0"
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
  1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of 0'-6" minimum movement of any portion of a human body that presents a target of not less than 36 square inches and detect a person of average size and weight moving not less than 1'-0" in either a horizontal or a vertical manner at an approximate speed of 1'-0" per second.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 sq. ft. when mounted on an 8'-0" high ceiling.

### **PART 3 - EXECUTION**

#### **3.01 WIRING DEVICES**

- A. Lighting outlet boxes to have 3/8" fixture studs.
- B. Exterior boxes shall be gasketed and watertight.
- C. Switch and device plates to be mounted with all four corners touching adjacent surface.
- D. All devices to be installed true and plumb.
- E. Switch plates and receptacles shall not be placed back-to-back in adjacent rooms. Offset locations a minimum of 0'-3" to restrict noise transfer. This shall also apply to TV outlets, telephone outlets, and data outlets.
- F. All devices on opposite side of a fire resistance rated wall assembly are to be separated by a horizontal distance of not less than 2'-0".
- G. Ground fault circuit interrupters shall be provided on all outdoor receptacle circuits, receptacle circuits within toilet and bathrooms, areas in close proximity to water, and wherever else indicated on the drawings or required by Code. While-in-use type covers are to be used in exterior wet locations.
- H. Tamper resistant receptacles are to be installed where indicated on the drawings. Refer to National Electrical Code 406.11 and 517.18 (C). Arc Fault Circuit Interrupters (AFCI) shall be provided on all 15 Amp and 20 Amp receptacle circuits in dwelling unit bedrooms.
- I. Dimmer switch devices shall be appropriately sized for derating when a minimum of two or more are ganged together in a common wall box.

#### **3.02 WIRING METHODS**

- A. Exposed interior wiring, panel feeders, home runs, equipment feeders; EMT. EMT conduit shall be securely fastened at intervals not exceeding 10'-0" and within 3'-0" of all boxes. NOTE: Exposed indicates all wiring methods is not installed within walls, above suspended ceilings, or within a pre-manufactured raceway. Any raceway that is to be exposed in a finished area is to be coordinated with the architect/ engineer prior to installation.
- B. Concealed branch circuiting above suspended ceilings, and in stud partitions; MC Cable. MC Cable shall be securely fastened at intervals not exceeding 4'-6", and within 1'-0" of all boxes or fittings. All home runs shall be in EMT.
- C. Wiring in concrete slabs or decks is not permitted unless approved by the architect or structural engineer.



- D. Exposed exterior wiring, Intermediate rigid conduit.
- E. Wiring below concrete slabs in earth: PVC conduit. \* Provide GRS conduit sweep elbow through concrete slab.
- F. Service wiring: PVC conduit encased in 0'-2" of reinforced concrete from utility transformer or pole to the building (below slab is not required to be encased).
- G. Concrete encasement: 0'-2" minimum cover around each conduit requiring encasement. Reinforcement consisting of 4" x 4" No. 4 wire mesh on top level of conduit.
- H. Emergency feeder from generator set (if outside building) to building; PVC conduit encased in 0'-2" of concrete, IMC within building.
- I. Minimum conduit size is 3/4".
- J. Flexible connections to all motors. Maximum length of flexible conduit is to be 3'-0".

### 3.03 RACEWAY SYSTEMS

- A. All secondary wiring shall be installed in rigid metal conduit, electrical metallic tubing, or MC Cable as specified in these Specifications.
- B. Electrical metallic tubing shall be employed in lieu of rigid metal conduit in all locations except:
  - 1. Underground
  - 2. In gravel, cinder, concrete, or other sub-base floor construction. PVC may be used under floor.
  - 3. Horizontal runs in concrete floor slabs. PVC may be used in slabs.
  - 4. Where subject to possible mechanical injury
  - 5. In masonry construction below finished grade. PVC may be used.
  - 6. Vertically in poured concrete walls.
  - 7. For service work
  - 8. For main distribution feeders
- C. All raceway components shall be fastened at intervals not exceeding 8'-0".
  - 1. Conduits shall not fasten or come in contact with piping of other trades as installed in this building.
  - 2. Conduit shall be separated not less than 6 inches from any water, steam or gas lines as may be installed in the building.
- D. Conduits and raceway systems shall be run concealed in walls, partitions, and floor slabs. Conduit which must be exposed shall be arranged as to not pass in front of windows, doors, access panels, access doors, sky lights, HVAC equipment access for coil removal or filter removal or required service clearances.
- E. Pulling fittings shall be provided for any conduit run which exceeds 200'-0" in length.
- F. All high voltage conduits (all conduit serving equipment over 600-volt) are to be painted red and labeled "HIGH VOLTAGE" on 10'-0" intervals. This does not apply to conduit below grade.
- G. All exposed fire alarm conduits are to be painted red, unless directed otherwise by the architect. This is to include the 120-volt branch circuit serving the control panel. Junction boxes are to be labeled "FIRE ALARM."
- H. All emergency circuits (MC cable and conduit) are to be painted red unless directed otherwise by the architect. Junction boxes are to be labeled "EMERGENCY 120." Appropriate voltage is to be indicated.
- I. All conduits and raceway components installed under this Section for completion by others shall be provided with a pull wire affixed at both ends of conduit.
- J. Insulating bushings shall be used on all conduit terminations entering enclosures, boxes, and panels to protect the conductor from damage during installation.

### 3.04 POWER WIRING

- A. Wire between motors, starters, disconnects and source.
- B. Verify proper motor rotation. Check for smooth operation.
- C. Furnish and install weatherproof disconnects, as indicated.
- D. All panel feeders shall be run in EMT raceway system.
- E. All wiring to roof top units, fans, and H&V units shall be installed complete between panel, disconnect switches and motor or unit connections.
- F. Disconnects shall be mounted adjacent to electrical and mechanical equipment. Indoor installations shall utilize NEMA 1 enclosures. Outdoor installations shall utilize NEMA 3R, weatherproof enclosures.

### 3.05 GROUNDING

- A. All electrical equipment and systems shall be grounded.
- B. Grounding system shall consist of a ground bus bar connected to a driven ground rod. Utilize ground type clamp fitting.
- C. All connections to conduit, equipment and devices shall be made with compression type connections.
- D. The grounding system shall comply with the National Electrical Code.
- E. All outside lighting fixtures and poles shall be grounded.
- F. All equipment and devices shall be grounded in accordance with the manufacturer's recommendations.
- G. The ground system shall have a resistance of 25 Ohms or less in compliance with the National Electrical Code. Utilize the fall of point method.
- H. Furnish a ground system test report at the completion of the work.
- I. Substation area grounding shall be in accordance with local utility company standards.

END OF SECTION

**SECTION 26 28 16 - SAFETY SWITCHES - GENERAL DUTY**

\* **Residential, light commercial.**

**PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 26 00 00 for requirements which are applicable to this section.
- B. Refer to NFPA and in particular National Electrical Code.
- C. Refer to NEMA, UL, and IEEE Standards.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish and install and place into operation safety switches where indicated on the drawings and specified herein.

**1.03 SUBMITTALS**

- A. Submit manufacturer's shop drawings of devices.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install systems and equipment in accordance with the National Electrical Code and local codes having jurisdiction.
- C. Provide adequate supervision of labor force to see that installations are correct.

**PART 2 - PRODUCTS****2.01 GENERAL DUTY SAFETY SWITCHES**

- A. APPLICATION DATA
  - 30 Amp-600 Amp
  - 240-volts AC
  - NEMA 1 - General Purpose, painted sheet steel
  - NEMA 3R - Rainproof, painted galvanized steel
  - Standard - Non time delay fuse
  - Maximum - Time delay (dual element) fuse
- B. CONSTRUCTION
  - Visible blades
  - Handle attached to box, not cover
  - Handle position indicates "ON" or "OFF"
  - Top hinged cover on NEMA 3R
  - Operating mechanism is quick-make, quick-break

- Plated current carrying parts
- Provisions for padlocking the switch in the "OFF" position
- Class R fuse kits for field installation
- C. NEUTRAL AND GROUNDING
  - Provisions for field installation of insulated, groundable neutral
  - Ground kits for field installation
- D. TERMINALS
  - UL listed for Al or Cu wires
  - UL listed for 60°C, or 75°C wires
- E. FUSE CLIPS
  - Spring reinforced
  - Plated
- F. APPLICATION
  - Fusible - Class H or Class R
  - Not fusible
- G. NEMA STANDARDS
  - KS1 - 1975
- H. UL LISTING
  - UL 98 Enclosed Switches
  - Maximum HP ratings
- I. UL LISTED SHORT CIRCUIT RATING:
  - 100,000 rms symmetrical amperes with proper rejection kit and Class R fuses
  - 10,000 rms symmetrical amperes with Class H fuses
- J. Acceptable Manufacturers:
  - 1. Siemens
  - 2. Cutler Hammer
  - 3. ABB Group
  - 4. Square D

### **PART 3 - EXECUTION**

#### **3.01 SAFETY SWITCHES**

- A. Furnish and install safety switches on all motors which do not have integral equipment disconnect devices, local starters and/ or where indicated on the drawings.
- B. Furnish and install fused safety switches where indicated on the drawings.
- C. Safety switches shall be installed to meet the area classification as to standard, hazardous, rainproof, etc.
- D. Safety switches shall be installed securely to building structure or be provided with supplemental support steel such as angle iron or uni-strut when required to locate on other than building structure.
- E. All safety switches shall be grounded.

END OF SECTION

**SECTION 26 30 00 - EMERGENCY POWER SYSTEM (DIESEL GENERATOR SET)****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for requirements which are applicable to this section.
- B. Refer to the requirements of the National Electrical Code and International codes.
- C. Refer to NFPA codes, particularly Pamphlet 37, 101 and 110.
- D. Refer to NECA/EGSA 404-2000 for general installation requirements.
- E. Refer to NFPA 99 for Health Care facilities.

**1.02 WORK INCLUDED**

- A. Provide labor, material, equipment, and supervision necessary to install a complete (stand-by) (emergency) power system and wiring system for emergency power, emergency lighting, fire alarm system, nurse call, emergency heat, and communications.
- B. System shall be complete with generator, engine, fuel system, ventilation system, exhaust system, (remote) monitoring, control wiring from automatic transfer switches, both new and existing, and concrete base.
- C. Provide labor, material, equipment, fuel, and supervision necessary to install a temporary portable diesel generator of similar size to maintain emergency power system during removal of existing generator and installation of new generator set.
- D. Provide code required signage (NEC 700.7, 701.7 and/or 702.7).

**1.03 SUBMITTALS**

- A. Furnish shop drawings and manufacturers descriptive literature on all aspects of the emergency generator. Include physical data, wiring diagrams, electrical data, installation requirements, operating instructions, and fuel consumption.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.

**PART 2 - PRODUCTS****2.01 GENERATOR SET MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. MTU Onsite Energy
  - 2. Caterpillar, Inc.
  - 3. Generac
  - 4. Cummins Power

## 5. Kohler Co.

## 2.02 ENGINE GENERATOR SET

- A. Furnish a coordinated assembly of compatible components.
- B. Output Connections: 3Ø-4W.
- C. Safety Standard: Comply with ASME B15.1.
- D. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of items.
- E. Limiting dimensions indicated for system components are not exceeded.
- F. Power Output Ratings: Nominal ratings as indicated, 300 KW with capacity as required to operate as a unit as evidenced by records of prototype testing.
- G. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.

## 2.03 GENERATOR-SET PERFORMANCE

- A. Steady-State Voltage Operational Bandwidth: 4% of rated output voltage from no load to full load.
- B. Steady-State Voltage Modulation Frequency: Less than 1 Hz.
- C. Transient Voltage Performance: Not more than 20% variation for 50% step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within three seconds.
- D. Steady-State Frequency Operational Bandwidth: 0.5% of rated frequency from no load to full load.
- E. Steady-State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- F. Transient Frequency Performance: Less than 5% variation for a 50% step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within five seconds.
- G. Output Waveform: At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5% total and 3% for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
- H. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, the system will supply a minimum of 250% of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.
- I. Start Time: Comply with NFPA 110, Type 10, system requirements.
- J. Air requirements: Maximum air requirements for combustion and cooling is to be as follows:

< 50 KW:	125 CFM/KW
50 KW - 100 KW:	90 CFM/KW
100 KW - 200 KW:	75 CFM/KW
> 200 KW:	60 CFM/KW

## 2.04 ENGINE

- A. Comply with NFPA 37.
- B. Fuel: Fuel oil, Grade DF-2.
- C. Rated Engine Speed: 1800 rpm.
- D. Maximum Piston Speed for Two-Cycle Engines: 1725 fpm (8.8 m/s).

- E. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
- F. Lubrication System: Pressurized by a positive-displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:
  - 1. Filter and Strainer: Rated to remove 90% of particles 5 micrometers and smaller while passing full flow.
  - 2. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail-safe.
  - 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.
- G. Engine Fuel System: Comply with NFPA 37. System includes the following:
  - 1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
  - 2. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns fuel to source.
- H. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment.
- I. Emissions: Exhaust emissions are to meet latest version of EPA Emission Standards for Compression Ignition Engines.

## 2.05 GOVERNOR

- A. Type: Isochronous

## 2.06 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pump.
- B. Radiator: Rated for specified coolant.
- C. Coolant: Solution of 50% ethylene-glycol-based antifreeze and 50% water, with anti-corrosion additives as recommended by engine manufacturer.
- D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- E. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
  - 1. Rating: 50-psig (345-kPa) maximum working pressure with 180° F (82° C) coolant, and non-collapsible under vacuum.
  - 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

## 2.07 FUEL SUPPLY SYSTEM

- A. Comply with NFPA 30 and NFPA 37.
- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, listed, and labeled fuel oil tank. Features include the following:
  - 1. Tank level indicators.
  - 2. \*Capacity: Fuel for eight hours of continuous operation at 100% rated power output.
  - 3. Vandal-resistant fill cap.
  - 4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

## 2.08 ENGINE EXHAUST SYSTEM (MUFFLER ONLY BY ELECTRICAL CONTRACTOR)

- A. Muffler: Critical type, sized as recommended by engine manufacturer. Measured sound level at a distance of 10'-0" (3 m) from exhaust discharge, is 85 dBA or less.
- B. Condensate Drain for Muffler: Schedule 40, black steel pipe connected to muffler drain outlet through a petcock.
- C. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- D. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.
- E. Supports for Muffler and Exhaust Piping: Spring hangers and all-thread rods and vibration hangers attached to building structure.
- F. Exhaust Piping External to Engine: ASTM A 53, Schedule 40, welded, black steel, with welded joints and fittings.
- G. Exhaust piping insulation: 0'-4" high temperature calcium silicate with aluminum jacket.

## 2.09 STARTING SYSTEM

- A. Description: 12V or 24V electric, with negative ground and including the following items:
  - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified.
  - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
  - 4. Battery: Lead Acid with adequate capacity within ambient temperature range.
  - 5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  - 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater is arranged to maintain battery above 10° C regardless of external ambient temperature. Include accessories required to support and fasten batteries in place.
  - 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 Amp minimum continuous rating.
  - 8. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type. Unit complies with UL 1236 and includes the following features:
    - a. Operation: Equalizing-charging rate of 10 Amps is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
    - b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40° C to plus 60° C to prevent overcharging at high temperatures and undercharging at low temperatures.
    - c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10%.
    - d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
    - e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either condition closes contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

## 2.10 CONTROL AND MONITORING



- A. Functional Description: When the mode-selector switch on the control and monitoring panel is in the "automatic position," remote-control contacts in one or more separate automatic-transfer switches initiate starting and stopping of the generator set. When the mode-selector switch is switched to the "on" position, the generator set manually starts. The "off" position of the same switch initiates generator-set shutdown. When the generator set is running, specified system or equipment failures or derangements automatically shut down the generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down the generator set.
- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages are grouped on a common control and monitoring panel mounted on the generator set. Mounting method isolates the control panel from generator-set vibration.
- C. Indicating and Protective Devices and Controls: Include the following:
  - 1. AC voltmeter.
  - 2. AC ammeter.
  - 3. AC frequency meter.
  - 4. DC voltmeter (alternator battery charging).
  - 5. Engine-coolant temperature gage.
  - 6. Engine lubricating-oil pressure gage.
  - 7. Running-time meter.
  - 8. Ammeter-voltmeter, phase-selector switch (es).
  - 9. Generator-voltage adjusting rheostat.
  - 10. Start-stop switch.
  - 11. Overspeed shutdown device.
  - 12. Coolant high-temperature shutdown device.
  - 13. Coolant low-level shutdown device.
  - 14. Oil low-pressure shutdown device.
  - 15. Fuel tank derangement alarm.
  - 16. Fuel tank high-level shutdown of fuel supply alarm.
  - 17. Generator overload.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.
- E. Remote Emergency-Stop Switch: Flush wall-mounted, unless otherwise indicated and prominently labeled. Push button is protected from accidental operation.
- F. Remote Alarm Annunciator: Comply with NFPA 99. Labeled LEDs identify each alarm event. Common audible signal sounds for alarm conditions. Silencing switch in face of panel silences signal without altering visual indication, connect so that after alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface or flush-mounting type to suit mounting conditions indicated. Locate at Nurse's Station as shown on drawings or as required by NFPA.

## 2.11 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
  - 1. Tripping Characteristic: Designed specifically for generator protection.
  - 2. Trip Rating: Matched to generator rating.
  - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  - 4. Mounting: Adjacent to or integrated with control and monitoring panel.
  - 5. Auxiliary contact(s): NC dry contacts which mimic generator circuit breaker position.

**2.12 GENERATOR, EXCITER, AND VOLTAGE REGULATOR**

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction prevents mechanical, electrical, and thermal damage due to vibration, over speed up to 125% of rating, and heat during operation at 110% of rated capacity.
- F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.
- G. Enclosure: Drip proof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
  - 1. Adjusting rheostat on control and monitoring panel provides plus or minus 5% adjustment of output- voltage operating band.
- J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- L. Sub transient Reactance: 12%, maximum.

**2.13 \*OUTDOOR GENERATOR-SET ENCLOSURE (SOUND ATTENUATED)**

- A. Description: Vandal-resistant, weatherproof steel or aluminum housing, non-hydroscopic sound attenuating material, UL 2200, wind resistant to at least 150 mph. Multiple doors are lockable and provide adequate access to components requiring maintenance. Instruments and control are mounted within enclosure. Sound attenuated to 70-73 dBA @ 7 meters.
- B. Muffler Location: Internal to enclosure.
- C. Engine Cooling Airflow through Enclosure: Adequate to maintain temperature rise of system components within required limits when unit operates at 110% of rated load for two-hours with ambient temperature at top of range specified in system service conditions.
- D. Louvers: Enclosed motor operated engine cooling air inlet and discharge. Louvers prevent entry of rain and snow.
- E. Automatic Dampers: At engine cooling air inlet and discharge. Dampers are closed to reduce enclosure heat loss in cold weather when unit is not operating.
- F. Maintenance Receptacle: 120V 20 Amp receptacle mounted on exterior of enclosure.
- G. Pre-wired AC Distribution: 100 Amp, 120/240 Volt, 1Ø load center for all AC power features (battery charger, battery heater, block heater, receptacles, etc.)

**2.14 FACTORY TEST**

- A. Provide a factory test and certified report of the test. Report shall substantiate the unit's full power rating, stability, voltage, and frequency regulation.
- B. Provide with the test report complete operating instructions and maintenance manuals with parts list and maintenance recommendations.

**2.15 LOAD BANK**

- A. Description: Permanent, outdoor, weatherproof, remote-controlled, forced-air-cooled, resistive, and reactive unit capable of providing a balanced three-phase, delta-connected

load to generator set at 100% rated-system capacity, at 80 percent power factor, lagging. Unit may be composed of separate resistive and reactive load banks controlled by a common control panel. Unit is capable of selective control of load in 25 percent steps with minimum step changes of approximately 5% and 10% available.

- B. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and steel supports. Elements are double insulated and designed for repetitive on-off cycling. Elements are mounted in removable aluminized-steel heater cases.
- C. Reactive Load Elements: Epoxy-encapsulated reactor coils.
- D. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor provides uniform cooling airflow through load elements. Airflow and coil operating current are such that, at maximum load, with ambient temperature at the upper end of the specified range, load-bank elements operate at not more than 50% of maximum continuous temperature rating of the resistance wire.
- E. Load Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors are located within a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.
- F. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.
- G. Load-Bank Enclosures: NEMA 250, Type 3R, complying with NEMA ICS 6. Louvers at cooling air intake and discharge openings prevent entry of rain and snow. Openings for airflow are screened with 1/2" (13mm) square galvanized steel mesh. Reactive load bank includes automatic shutters at air intake and discharge.
- H. Protective Devices: Power input circuits to load banks are fused, and fuses are selected to coordinate with generator circuit breaker. Fuse blocks are located within contactor enclosure. Cooling airflow and over temperature sensors automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors disconnect load power, control, and heater circuits. Fan motor is separately protected by overload and short-circuit devices. Short-circuit devices are non-interchangeable fuses with 200,000 Amp interrupting capacity.
- I. Remote-Control Panel: Separate from load bank in a NEMA 250, Type 1 enclosure. Includes a control power switch and pilot light, and switches controlling groups of load elements.
- J. Control Sequence: Control panel may be preset for adjustable single step loading of generator during automatic exercising.

## 2.16 OTHER PRODUCTS

- A. Wiring system
  - 1. Refer to Section 26 27 00 for product information.
- B. Emergency Lighting
  - 1. Refer to Section 26 50 00 for product information.
- C. Fire Alarm System
  - 1. Refer to Section 28 30 00 for product information.
- D. Nurse Call System
  - 1. Refer to Section 26 36 23 for product information.
- E. Automatic Transfer Switches
  - Refer to Section 26 36 23 for product information.

## PART 3 - EXECUTION

**3.01 WIRING**

- A. Prior to acceptance of portable generator set, perform 100% rated output test at construction site with temporary load bank of appropriate size. Upon acceptance, make temporary connections as required.
- B. All wiring shall be in galvanized steel conduit and shall be installed in accordance with the manufacturers wiring diagrams.
- C. Wiring shall be in accordance with the NEC and the local authorities having jurisdiction.
- D. Connections to the generator shall be made flexible.
- E. Provide control wiring from all automatic transfer switches (including those provided under separate contract, such as fire pump controllers) to the generator.
- F. Provide power to all generator required auxiliary systems (such as, block heater, battery charger, battery heater, etc.) as indicated on the drawings or from the panel as directed by the owner/architect/engineer.

**3.02 GENERATOR**

- A. The generator shall be mounted on a concrete slab, minimum 0'-6" thick reinforced concrete. Pad is to extend 0'-6" beyond the footprint of the generator in each direction.
- B. Arrange for fuel installation of diesel fuel.
- C. Install a 1" static deflection vibration isolation.
- D. Install critical muffler and muffler tailpipe to the exterior. Muffler/tailpipe shall be flexibly coupled to the engine with a stainless-steel exhaust connector.

**3.03 TESTING**

- A. Perform field quality control testing under the supervision of the manufacturer's factory authorized service Representative.
- B. Furnish load bank of adequate size to test generator at 100% rated output prior to connection to building emergency power system.
- C. Perform tests as recommended by manufacturer.
- D. Coordinate tests with tests of automatic transfer switches and run them concurrently.
- E. Correct deficiencies identified by tests and retest until requirements are met.

**3.04 DEMONSTRATION**

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the emergency generator set.
- B. Coordinate this training with that of the transfer switches.
- C. The minimum training session is to be eight hours.

END OF SECTION

**SECTION 26 36 23 - AUTOMATIC TRANSFER SWITCH****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to section 26 00 00 for requirements which are applicable to this section.
- B. Refer to National Electrical Code.
- C. Refer to NEMA, UL and IEEE Standards.
- D. Refer to NFPA 110.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to furnish, install, and place into operation automatic transfer switches with number of poles, amperage, voltage and withstand ratings as indicated on the plans and specified herein.
- B. Provide necessary controls between the automatic transfer switch and the power system to insure proper operation and power transfer.

**1.03 SUBMITTALS**

- A. Submit shop drawings of switch and accessories.
- B. Submit manufacturer's data sheets of equipment.
- C. Submit manufacturer's certificates of conformance with applicable codes.
- D. Submit wiring diagrams of switch and accessories.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install systems and equipment in accordance with NEC.
- C. Provide adequate supervision of labor force to see that installations are correct.

**PART 2 - PRODUCTS****2.01 AUTOMATIC TRANSFER SWITCH**

- A. Furnish and install switch system(s) with number of poles, amperage, voltage and withstand ratings as shown on the plans. The system shall comply with the latest requirements of Underwriters' Laboratories UL Std. 1008 and NEMA ICS10-1993, (formerly Std. ICS 2-447). In addition, the switch performance must meet or exceed the following requirements and, if so requested, be verified by certified laboratory test data: Temperature Rise, withstand, dielectric and transient withstand tests.
- B. Automatic transfer switch systems shall meet all the requirements of the specification and as a minimum be equal to an ASCO 300 Series.

- C. Acceptable Manufacturers: ASCO, Russelectric, Zenith, Kohler (Detroit Diesel), ONAN, or Caterpillar.

## 2.02 AUTOMATIC TRANSFER SWITCH OPERATION

- A. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be one-sixth of a second or less. Mechanical locking in each position shall be accomplished without the aid of permanent magnets, latching solenoids or power operators. Operation shall be true double throw with no possibility of a neutral position. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and power conductors. A manual operating handle shall be provided for maintenance purposes.
- B. The automatic transfer switch shall include a separately mounted control panel with adjustable solid-state sensing and timing functions. The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and with inherent digital serial communications capability. The control module shall be connected to the transfer switch by an interconnection wiring harness. The harness shall include a keyed disconnect plug to enable the control module to be disconnected from the transfer switch for routine maintenance.
- C. Where neutral conductors must be switched, the ATS shall be provided with fully rated neutral transfer contacts. When neutral conductors are to be solidly connected, a neutral terminal plate with fully rated AL-CU pressure connectors shall be provided.
- D. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.
- E. Provide strip heater with thermostat for Type 3R enclosure requirements.
- F. Controller shall be flush-mounted display with LED indicators for switch position and source acceptability. It shall also include test and time delay bypass switches.

## 2.03 STANDARD ACCESSORIES

- A. 1-3 second adjustable transfer time delay. (1 second factory set)
- B. 0-5 minute adjustable time delay on transfer to emergency. Controls loading of generator. (0 minutes factory set)
- C. 0-30 minute adjustable time delay on retransfer to normal. Time delay is automatically bypassed if emergency source fails. (30 minutes factory set)
- D. Toggle switch- Manually bypasses time delay on retransfer.
- E. 5 minute cool-down time delay on engine shutdown.
- F. Adjustable close differential voltage sensing of all normal source phases.
  1. Pickup voltage 85-100% (Factory set - 95% of nominal voltage)
  2. Dropout voltage 70-90% (Factory set - 85% of nominal voltage)
- G. Adjustable independent emergency voltage and frequency sensing.
  1. Pickup voltage 85-100% (Factory set - 90% of nominal voltage)
  2. Pickup frequency 90-100% (Factory set - 95% of nominal frequency)
- H. All settings field adjustable with no special tools required.
- I. Test switch - Simulates failure of normal source. (Momentary type)
- J. Gold plated engine starting contacts. (10-ampere SPDT)
- K. Pilot lights- Indicate switch position. Auxiliary contacts-1-N/C and 1-N/O on "Normal" (10 amps,

- 480 VAC.)
- L. Microprocessor- Output terminals shall be provided to signal the actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.
  - M. An engine generator exerciser shall be provided where so indicated on the plans. The exercising timer shall be built-in to the ATS module and shall include a selector switch to select exercise with or without load transfer. Exercise setting shall be set by pushbutton and a digital display shall be provided to indicate settings.
  - N. An in-phase monitor shall be inherently built into the controls. The monitor shall control transfer/retransfer operation between live sources so that closure on the alternate source will occur only when the two sources are within 15 electrical degrees maximum so that inrush currents do not exceed normal starting currents. The monitor shall function over a frequency difference range of up to +2.0 Hz with maximum operating transfer time of one-sixth of a second. If the voltage of the load-carrying source drops below 70%, the in-phase function shall be automatically bypassed. The monitor shall not require inter-wiring with the generator controls, or active control of the governor.
  - O. Switched neutrals (shown as 4 pole switches on the drawings) shall have fully rated neutral transfer contacts.

#### 2.04 ASCO OPTIONAL ACCESSORY NUMBER - 72A

- A. Serial communications: The control module shall include provisions for future serial communications capability. Serial communication shall provide for remote: position indication, testing, source availability (as defined by the actual pick-up and drop-out settings), and indication of any time delay currently in operation of all Automatic Transfer Switch(es).

#### 2.05 ASCO OPTIONAL ACCESSORY NUMBER 44G

- A. Enclosure Heater - a 125 W enclosure heater with transformer and thermostat, adjustable from 30°F to 140°F.

#### 2.06 WITHSTAND AND CLOSING RATINGS

- A. The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of over-current protection shown on the plans. WCR ATS ratings as be as follows when used with specific circuit breakers:

ATS Size	Withstand & Closing Rating MCCB	W/CLF
30	22,000A	100,000
70 - 200	22,000A	200,000
230	22,000A	100,000
260 - 400	42,000A	200,000
600 - 1200	65,000A	200,000
1600 - 2000	85,000A	200,000
2600 - 3000	100,000A	200,000

### PART 3 - EXECUTION

### 3.01 AUTOMATIC TRANSFER SWITCHES

- A. Furnish and install automatic transfer switches on all motors which do not have integral equipment transfer switches.
- B. Furnish and install automatic transfer switches where indicated on the drawings.
- C. Automatic transfer switches shall be installed to meet the area classification as to standard, hazardous, rainproof, etc.
- D. Automatic transfer switches shall be installed securely to building structure or be provided with supplemental support steel such as angle iron or unistrut when required to locate on other than building structure.
- E. All automatic transfer switches shall be grounded.
- F. Furnish and install control wiring from each automatic transfer switch to the generator.
- G. Power transfer shall be as follows:
  - 1. Life Safety ATS: Within 10 seconds of power failure.
  - 2. Standby power ATS: Staggered from one minute to five minutes past the power failure to ensure generator accepts the loads. Coordinate ATS transfer with owner (i.e., ATS for HVAC may be more critical than UPS transfer).
  - 3. Fire Pump: Within ten seconds of power failure.

### 3.02 TESTING

- A. Perform field quality control testing under the supervision of the manufacturer's factory authorized service representative. Coordinate testing with that of emergency generator testing.

### 3.03 DEMONSTRATION

- A. Engage a factory authorized service representative to train owner's personnel to adjust, operate, and maintain transfer switches. Coordinate training with generator equipment training.

END OF SECTION



**SECTION 26 43 13 - SURGE SUPPRESSION****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for requirements which are applicable to this section.
- B. Refer to National Electrical Code.
- C. Refer to UL, ANSI, IEEE, and NEMA Standards.
- D. Refer to Computer Business Manufacturer's Association (CBEMA), Information Technology Industry Council (ITIC) and International Electrotechnical Commission (IEC) for clamping voltage tolerance guidelines for sensitive equipment.

**1.02 WORK INCLUDED**

- A. Provide all labor, material, equipment, and supervision necessary to install and place into operation surge suppression where indicated on drawings and/or specifications.

**1.03 SUBMITTALS**

- A. Submit shop drawings, product data, and manufacturer's installation instructions.
- B. The surge suppression submittal shall also include:
  - 1. Dimensional drawing of each suppressor type indicating mounting arrangements.
  - 2. UL 1449 Third Edition documentation (SCCR, VPR, MCOV, I-n).
- C. All Surge Protective Devices shall be of the same manufacturer.

**1.04 QUALITY ASSURANCE**

- A. Verify that all equipment is installed in accordance with the manufacturer's warranty requirements.
- B. Install equipment with accordance with National Electrical Code.
- C. Provide adequate supervision of labor force to see that installations are correct.
- D. Surge protection devices shall be manufactured in the USA, by a company normally engaged in the design and manufacture of such devices for at least ten years.

**1.05 SAFETY AGENCY APPROVALS**

- A. Suppressers shall be listed in accordance with UL 1449 3rd Edition documentation, standard for safety, surge protective devices and meet requirements in UL 1283 for electromagnetic interference filters.

**PART 2 - PRODUCTS****2.01 SERVICE ENTRANCE**

- A. Surge protection devices shall be installed at all service entrances of each building and/ or as shown on the riser diagram.
- B. Suppressers shall be tested per ANSI/IEEE C62.45.
- C. Wye systems shall have suppression elements between each phase conductor and the system neutral, between each phase conductor and the system ground and between the neutral conductor and ground (true 10-mode protection).
- D. Each phase shall have a minimum of two modules. The surge modules shall be fused at a minimum rating of 30 Amp. Modules and fuses shall be field replaceable. Fuses shall be surge suppression fuses. (Ferraz Shawmut VPS Series)
- E. Visible indication of proper suppresser connection and operation shall be provided. The indicator shall consist of an LED array. No single LED or neon indicators will be used.
- F. The surge protection device shall be equipped with an audible alarm that shall actuate when any part of the surge circuitry has been damaged. A silence button shall be provided with the alarm.
- G. The suppressor shall exhibit Sine Wave Tracking circuitry and shall provide high frequency noise filtering up to 50dB attenuation (100 kHz-100 MHz).
- H. Suppressors shall meet or exceed the following criteria:
  - 1. Minimum single impulse current rating (L-N + L-G): 160,000 Amp per phase, 80 kA per mode.
  - 2. Incorporate hybrid circuitry.
  - 3. UL 1449 3rd Edition voltage protection ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-L	L-L	MCOV
120/208	800	800	800	1200	150
277/480	1200	1200	1200	2000	320

- I. Suppressors shall exhibit redundant protection for each phase and consist of solid-state components and shall operate bi-directionally.
- J. Suppressor shall be equipped with a surge counter with a reset and battery backup.
- K. Suppressor short circuit current rating shall meet or exceed that of the service panelboard.
- L. Total Protection Solutions (Joslyn) Surge Track ST160 or approved equivalent by Advanced Protection Technologies, Inc., Siemens, ABB Group, Eaton, Square D, or LEA International.

## 2.02 SECONDARY DISTRIBUTION INTEGRATED SUPPRESSION PANELS:

- A. Surge Protective Devices shall be installed in secondary distribution panels as shown on the riser diagram.
- B. Suppressor shall be tested per ANSI/IEEE C62.45.
- C. Wye systems shall have suppression elements between each phase conductor and the system neutral, between each phase conductor and the system ground and between the neutral conductor and ground (true 10-mode protection).
- D. Visible indication of proper suppressor connection and operation shall be provided.
- E. The surge protective device shall be equipped with an audible alarm that shall actuate when any part of the surge circuitry has been damaged. A silence button shall be provided with the alarm.
- F. The suppressor shall exhibit Sine Wave Tracking circuitry. The surge suppressor shall have suppression circuitry that is field replaceable without disturbing the conduit or enclosure.
- G. Suppressors shall meet or exceed the following criteria:
  - 1. Minimum single impulse current rating (L-N + L-G): 80,000 amperes per phase, 40kA per mode.

2. UL Clamping voltage shall not exceed the following:

VOLTAGE	L-N	L-G	N-L	L-L	MCOV
120/208	800	800	800	1200	150
277/480	1200	1200	1200	2000	320

- H. Suppressors shall consist of solid-state components and operate bi-directionally. The manufacturer of the surge panel shall offer either a surface or flush cover, as required by the job conditions.
- I. Suppressor short circuit current rating shall meet or exceed that of the panelboard.
- J. Total Protection Solutions (Joslyn) Surge Track ST80 or approved equivalent by Advanced Protection Technologies, Inc., LEA International, Siemens, GE, Eaton, or Square D.

### PART 3 - EXECUTION

#### 3.01 SERVICE ENTRANCE

- A. Install one primary suppressor at each utility service entrance. Follow manufacturer's installation instructions.
- B. Suppressor shall be installed on the load side of the service entrance.
- C. Conductors between suppressor and point of attachment shall be at least #6 AWG stranded copper conductor or larger. The conductors shall be kept as short and straight as possible. Lead length of connecting conductors shall be within 3'-0".
- D. Suppressor's ground shall be bonded to the service entrance ground.

#### 3.02 SECONDARY DISTRIBUTION PANELS

- A. Install one secondary suppressor at each distribution panel location or as indicated on the riser diagram. Follow manufacturer's installation instructions.
- B. Suppressor shall be installed on the service panel, per the manufacturer's installation instructions. Contractor shall install circuit breaker in panel to attached surge panel to electrical distribution system if necessary.
- C. Conductors between suppressor and point of attachment shall be at least #6 AWG stranded copper conductor or larger. The conductors shall be kept as short and straight as possible. The maximum length of connecting wiring shall not exceed 1'-6". Pre-wired suppressors with conductors smaller than #6 wire are not acceptable.
- D. Suppressor's ground shall be connected to the distribution panel ground.

#### 3.03 CERTIFIED TESTS

- A. The surge suppresser manufacturer shall provide certified test results on the actual product being shipped to the job site. The test results shall be certified by an officer or engineer of the company as being performed on the product after manufacture.
- B. The test conducted shall be per ANSI/IEEE C62.45. The units shall be tested in all modes listed in this specification.

#### 3.04 WARRANTY

- A. The surge suppresser shall warrant the surge protective devices and supporting components against defects in material and workmanship for a minimum period of five years.

3.05 TESTING

- A. Perform field quality control testing under the supervision of the manufacturer's factory authorized service representative.

3.06 DEMONSTRATION

- A. Engage a factory authorized service representative to train owner's personnel to adjust, operate, and maintain equipment.

END OF SECTION

**SECTION 26 50 00 - LIGHTING****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for other requirements of this Section.
- B. All work to conform to the NFPA 70 National Electrical Code.
- C. Provide interior lighting controls to meet the adopted IBC / IECC / ASHRAE 90.1 code. Refer to Specification Section 26 09 00 for additional requirements.
- D. Refer to standards of the Illuminating Engineering Society.
- E. All exit and emergency lighting shall comply with NFPA Life Safety Code 101, ADA, and other local codes as may apply.

**1.02 SCOPE**

- A. Furnish and install a complete and operating lighting system, including all luminaires, wiring, lamps, and 0-10V dimmable LED drivers.
- B. All lighting outlets shall have a luminaire. If a luminaire designation is missing, furnish and install a luminaire in similar use in the project.
- C. All luminaires shall have a home run. If these are omitted on the drawings the contractor shall allow for a home run to the nearest appropriate panel.
- D. All rooms are to be provided with lighting controls. Provide manual switch and code required control devices as appropriate. If controls are not indicated within a space, controls are to be provided for the space in a similar manner as adjacent or similar spaces.
- E. Provide exit and emergency lighting as required by Code in all spaces to meet requirements of the AHJ. Allow for ten additional luminaires to be installed where directed by the AHJ.

**1.03 MOUNTING**

- A. The contractor shall be responsible for selecting mounting arrangements of luminaires to suit the construction or ceiling types. Contractor or his agent shall review architectural drawings to establish ceiling types prior to preparing shop drawings for submission. It is NOT to be understood that the luminaire schedule accounts for the mounting types. Frequently ceiling types are changed after the luminaire schedule has been completed.
- B. Luminaires shall be mounted on structurally secure supports. The contractor shall provide miscellaneous steel supports to span between structural elements to provide a base of support for the luminaires at the locations shown on the drawings. Refer to architectural and structural drawings for locations of beams, joists, purlins, etc.
- C. Exterior luminaires shall be mounted with anchor bolts of suitable size secured into concrete bases. The mounting arrangement shall be capable of withstanding a continuous wind of 100 MPH with gales to 130 MPH. EPA of luminaire shall be rated with pole to provide required performance.

**1.04 APPROVALS**

- A. Furnish shop drawings and catalog cuts of all luminaires for review by the engineer prior to ordering.

- B. Provide samples of any luminaire or luminaires when requested by the owner, architect, or engineer.
- C. Provide a point-by-point lighting level calculation for parking areas, areas when requested by the engineer, and for high profile areas (i.e., main lobbies, atriums, pools, gymnasiums, etc.), when an alternate manufacturer or luminaire is being presented for approval. Calculation shall be provided by the manufacturer or the local manufacturer's representative. Footcandle levels are to be indicated at a maximum of 10'-0" intervals (exterior) or 5'-0" intervals (interior). A drawing is to be provided at the same scale as the contract documents.

## PART 2 - PRODUCTS

### 2.01 LUMINAIRE REQUIREMENTS

- A. Luminaires shall be complete with wiring, lamp holders, lamps, reflectors, glassware, canopies, shades, bases, pendants, etc.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Luminaires shall be wired with type AF luminaire wire.
- D. Plastic lenses shall not be used. Provide either virgin acrylic, high impact polycarbonate or tempered glass or as specified in the luminaire schedule. Lens thickness shall be a minimum of 1/8".
- E. Any exposed luminaire housing surface, trim frame, door frame and lens frame shall be free of light leaks either between luminaire components or between luminaire and adjacent surface.
- F. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.
- G. Hinged door closure frames shall operate smoothly and easily without binding when installed and latches shall function easily by finger action without the use of tools.
- H. Recessed luminaires installed in an insulated ceiling shall be listed for use in insulated ceilings.
- I. Luminaires in damp areas shall be gasketed, vapor tight, and fabricated with aluminum instead of steel. These luminaires shall have pressure clamping devices in lieu of latches.
- J. Luminaires located in other harsh environments are to be of suitable construction and finish for the intended environment in addition to the requirements listed in the Lighting Luminaire Schedule.
- K. All luminaire lenses shall, from the manufacturer, be shipped within a protective covering, i.e. plastic bag, paper wrapped, to prevent dust, dirt, smudges prior to final acceptance.
- L. Drivers shall be easily serviceable when installed and shall not be mounted to removable reflectors or wire way covers.
- M. Luminaires shall have a minimum CRI of 80 and a CCT of 3500 K.
- N. Luminaires shall have a rated lamp life of 50,000-hours to L70.
- O. Luminaires shall be dimmable from 100% to 10% of maximum output.

### 2.02 LED DRIVERS

- A. Shall be internal.
- B. Shall be designed for ten-year operational life.
- C. Shall be designed to withstand electrostatic discharges according to IEC 61000-4-2.
- D. Shall be furnished with poke-in wire trap connectors, color coded to ANSI standard C82.11.
- E. Shall operate from a line voltage range of 108-305-volts, 50/60 Hz.
- F. Input current shall have Total Harmonic Distortion (THD) of less than 20% with a power factor of

>.90% to comply with ANSI standard C82.11

- G. Shall meet UL 8750, UL 1012, and UL 1310 as applicable in NFPA compliant installations.
- H. Shall have no visible output change at  $\pm 10\%$  line voltage input.
- I. Shall have a Class A sound rating (inaudible at 27dBA ambient noise level).
- J. Shall have a universal input voltage (120-277V/ 50-60Hz).
- K. Shall be Underwriters Laboratories (UL) Listed (Class P) and CSA Certified where applicable and rated for use in air handling spaces.
- L. Shall carry a five-year warranty from the date of manufacture for operation at a case temperature of 75°C or less. When operated at a case temperature between 75°C and 85°C, the warranty shall be three years from the date of manufacture.

## 2.03 LED EQUIVILANT LAMPS

- A. LED: ENERGY STAR Certified, NRTL compliant, FM Global compliant. Recessed luminaires shall comply with NEMA LE4, CRI: 80, CCT: 3500 K. Lamps dimmable from 100% to 10% of maximum light output, 50,000-hour lamp rated life, internal driver must be UL Listed, dimmable with any standard dimmer switch, smooth, flicker-free dimming.
- B. Manufacturers; Philips, Feit, Sylvania, GE, Archipelago.
- C. Contractor is to coordinate lamp color for all luminaires. Lamp color is to be similar in all spaces.

## 2.04 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction. Refer to Luminaire Schedule on drawings.
- B. Internally lighted Signs:
  - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
  - 2. Self-Powered Exit Signs (Battery Type) Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80% of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

# PART 3 - EXECUTION

## 3.01 LUMINAIRES

- A. All recessed LED troffers (2' x 2', 2' x 4', and 1' x 4') and recessed luminaires weighing up to 20 lbs. are to be installed in grids with mounting clips and with grid secured at diagonal corners of luminaire

- to the building structure. (4' x 4') luminaires to be secured at four corners.
- B. Recessed luminaires between 20 and 50 pounds are to have, in addition to above, 12-gauge steel safety chains at opposite corners hung slack from the building structure. Luminaires above 50 pounds to be independently supported directly from the structure with approved hangers and angular sway bracing according to manufacturer's installation guidelines.
  - C. Surface mounted and pendant luminaires under 15 pounds can be supported directly from the outlet box when all of the following apply: screws pass through round holes and not key slots in the luminaire body, the outlet box is attached to a main ceiling runner, and the outlet box is supported vertically from the building structure.
  - D. Surface luminaires between 15 and 50 pounds shall be bolted to the ceiling independent of the outlet box. Luminaires over 50 pounds shall be secured to the building structure using a manufacturer's approved mounting method.
  - E. Luminaires to be set plumb.
  - F. Provide 6'-0" flexible leads on recessed luminaires to allow for easy removal.
  - G. Recessed luminaires shall be set with mounting frames.
  - H. Coordinate final location of all luminaires with other disciplines to avoid interferences and potential obstructions as the work progresses.
  - I. Luminaires used for temporary lighting during construction shall be removed, cleaned, and re-installed prior to acceptance of the lighting system.
  - J. Luminaires shall be cleaned and free of all dirt, dust, smudges, and surface imperfections just prior to final acceptance.
  - K. Luminaires which are recessed in a fire rated ceiling shall be provided with an enclosure around the luminaire which shall maintain the fire rating integrity of the ceiling system. The installation of the enclosure shall meet the requirements of the authority having jurisdiction. The luminaire shall be insulation rated for higher temperature operation.
  - L. All recessed or surface mounted luminaires on or in sloped ceilings shall have sloped ceiling adapters to allow for vertical light distribution.

### 3.02 SWITCHING

- A. Provide lighting control switch legs to wall switches for all luminaires except for those operated by integral switches.
- B. Provide 3-way or 4-way control where indicated and for rooms with more than one entrance.
- C. Provide a single time clock, contactors and relays as indicated on the drawings and as necessary for site lighting and parking lot lighting control.
- D. Provide interior lighting controls to meet IBC 2015/IECC 2015/ ASHRAE 90.1. Refer to Specification Section 26 09 00 for additional requirements.

END OF SECTION



**SECTION 26 60 00 - SERVICE AND DISTRIBUTION****PART 1 - GENERAL****1.01 ELECTRIC SERVICE**

- A. Primary electric service shall be provided by contractor from utility pole underground via pull hole at property line to transformer. Secondary shall be provided by contractor from transformer to building service entrance gear. Contractor shall furnish and install all work required by the utility company for service.
- B. Contractor shall coordinate his schedule with the utility for completion of the installation and energization of the services.
- C. Contractor shall provide metering conduit between current transformer and final location of meter as determined by the utility company.

**1.02 REFERENCE**

- A. Refer to Section 26 00 00 for additional requirements of this section.
- B. Refer to requirements of the National Electrical Code and the utility company.

**PART 2 - PRODUCTS****2.01 UNDERGROUND SERVICE**

- A. U. L. listed Schedule 40 PVC conduit underground encased in 2" of reinforced concrete. Reinforcement shall include 4" x 4" No. 4 wire mesh on top level of conduit.
- B. Seal both ends of conduits with duct seal.
- C. Coupling shall be watertight.
- D. All service conduits shall be encased in concrete envelope.

**2.02 SECONDARY SERVICE CABLE**

- A. Copper conductors, 75 degrees C, 600V, thermoplastic insulation and neoprene outer jacket, U. L. listed. Type THWN.
- B. Manufacturers: Triangle, General Cable, Southwire.

**2.03 TRANSFORMER VAULT**

- A. Precast transformer vault, 7 feet x 7 feet x 4 feet 6 inches deep as manufactured by Penn-Cast Products, or A.C. Miller Concrete Products. Must be approved by Utility Company.

**2.04 PRIMARY CABLE**

- A. 5 kV, 15 kV, or 35 kV cable shall be provided as directed by utility company. Acceptable manufacturers: American Wire and Cable Company, General Cable Company. Okenite

Company, or Prysmian Power Cable. Must be approved by Utility Company.

## 2.05 PRIMARY DUCT

- A. 5" duct as recommended by Utility Company.

## PART 3 - EXECUTION

### 3.01 SERVICE

- A. Underground excavation shall be open cut, trenching to appropriate depth.
- B. Conduit shall not rest on rock or boulders.
- C. Backfill in 12" layers and pneumatically tamp.
- D. Sod disturbed grass areas.
- E. Provide new concrete or asphalt walks, curbs, driveways to match adjacent and original surfaces.
- F. Provide a concrete encasement of service conduits from utility pole or transformer to the building.
- G. Primary cable and duct shall be installed from transformer location to utility pole as designated by Utility Company, by the Electrical Contractor.
- H. Provide 10' of slack in cable for Utility Company connections.

### 3.02 POWER WIRING

- A. Wire between motors, starters, disconnects and source.
- B. Verify proper motor rotation.
- C. Furnish and install weatherproof disconnects, as indicated.
- D. All panel feeders shall be run in EMT raceway system.
- E. All wiring to roof top units, fans, equipment, and HVAC equipment shall be installed completely between panels and disconnect switches, and motors.
- F. Disconnects shall be mounted adjacent to electrical and mechanical equipment. Indoor installations shall utilize NEMA 1 enclosures. Outdoor installations shall utilize NEMA 3R enclosures.

### 3.03 GROUNDING

- A. All electrical equipment and systems shall be grounded.
- B. Grounding system shall consist of a ground bus bar connected to a driven ground rod. Utilize ground type clamp fitting.
- C. All connections to conduit, equipment and devices shall be made with compression type connections.
- D. The grounding system shall comply with the NEC.
- E. All outside lighting fixtures and poles shall be grounded.
- F. All equipment and devices shall be grounded in accordance with the manufacturer's recommendations.
- G. The ground system shall have a resistance of 25 ohms or less in compliance with the NEC.
- H. Furnish a ground system test report at the completion of the work.
- I. Substation area grounding shall be in accordance with Utility Company standards.

END OF SECTION

## SECTION 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Grounding/Earthing and bonding for Low Voltage systems such as telecommunications and audiovisual systems.
2. Primary Bonding Busbar (PBB)
3. Secondary Bonding Busbar (SBB)
4. Telecommunications Bonding Backbone (TBB)
5. Backbone Bonding Conductor (BBC)
6. Rack Bonding Busbar (RBB)
7. Telecommunications Equipment Bonding Conductor (TEBC)
8. Telecommunications bonding conductor (TBC)
9. Pathways.

##### B. Related Sections:

1. Division 26 Section *Grounding and Bonding* for building systems with which to interface with Work of this Section.

#### 1.2 DEFINITIONS

- A. AFC: Above Finished Ceiling
- B. BICSI: Building Industry Consulting Service International.
- C. Bonding: Permanent joining of metallic parts to form an electrically conductive path to ensure electrical continuity and capacity to safely conduct current.
- D. Common Bonding Network (CBN) – The principal means for affecting bonding and earthing inside a building.
- E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- F. EMI: Electromagnetic interference.
- G. Ground/Earth – A conducting connection, whether intentional or incidental, by which an electric circuit or equipment is connected to ground, or to some conducting body of relatively large extent that serves in place of the ground.

- H. HC: Horizontal Cross Connect
- I. IDC: Insulation displacement connector.
- J. LAN: Local Area Network.
- K. MC: Main Cross-connect
- L. NEBS: Network Equipment Building System.
  - 1. NEBS Level 3: Equipment complies with strict specifications for fire suppression, thermal margin testing, vibration resistance including seismic, airflow patterns, acoustic limits, failover and partial operational requirements such as chassis fan failures, failure severity levels, RF emissions and tolerances, and testing/certification requirements.
- M. NEC: National Electric Code
- N. RCDD: Registered Communications Distribution Designer.
- O. TR: Telecommunications Room
- P. UTP: Unshielded twisted pair.

### 1.3 SYSTEM DESCRIPTION

- A. Provide a complete and functioning Telecommunications grounding/earthing system inclusive of all hardware, software and training to meet or exceed the performance features outlined in this document.
- B. Purpose: Telecommunications grounding/earthing system creates a low impedance path to earth ground to prevent damage to equipment and disruption in service due to electrical surges and transient voltages.
- C. Grounding/earthing system comply with following:
  - 1. NEC and local electrical codes
  - 2. ANSI/TIA-607-D or latest version.
  - 3. ISO/IEC 30129
  - 4. IEEE 1100
- D. Secondary Bonding Busbar (SBB): Ground/earth each telecommunications space to the Primary Bonding Busbar (PBB) located at the telecommunications entrance room.

### 1.4 SUBMITTALS

- A. Comply with Division 01330 Section *Submittal Procedures*.
- B. Submittal data is to be submitted electronically. Each submittal shall contain the below in the following order:
  - 1. Cover Sheet.

- a. Include name of supplying contractor and project name.
2. Detailed Bill of Materials.
  - a. Include a listing of: component quantities, equipment manufacturer, model number, and description of each component being supplied, and the specification paragraph or drawing sheet that corresponds to the product. Failure to provide this information will result in the rejection of submittals.
3. Product Data.
  - a. Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product. Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures. If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight.

#### C. Shop Drawings

1. Wiring diagram to show grounding schematics, including the following: Busbars and bonding backbone. Detail mounting assemblies and show elevations and physical relationship between the installed components.
2. Show the relationship of TR's, the pathway between them, and cable connectivity to be installed.
3. Drawings should be at project standard scale clearly legible.

### 1.5 QUALITY ASSURANCE

#### A. Regulatory Requirements, grounding/earthing and bonding systems:

1. TIA/EIA
  - a. TIA-942 Telecommunications Infrastructure Standard for Data Centers
  - b. J-STD-607-D Commercial Building Grounding/Bonding Requirements
  - c. TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
2. IEEE
  - a. Std 1100 IEEE Recommend Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book)
3. Telcordia:
  - a. NEBS 3 as defined for RBOC-CO compliance.
4. NFPA
  - a. NFPA-70 National Electric Code (NEC)

B. Testing Procedures:

1. NEBS GR-63-CORE: Network Equipment-Building System Requirements: Physical Protection.
2. NEBS GR-1089-CORE: Electromagnetic Compatibility and Electrical Safety -- Generic Criteria for Network Telecommunications Equipment

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, Grounding/Earthing Systems:

1. Panduit
2. Chatsworth
3. Harger
4. Burndy
5. Ortronics/Legrand
6. Erico

B. Acceptable Manufacturers, Telecommunications Bonding Busbars:

1. Panduit
2. Chatsworth
3. Harger
4. Burndy
5. Ortronics/Legrand
6. Erico

C. Acceptable Manufacturers, Rack Bonding Kits:

1. Panduit
2. Chatsworth
3. Harger
4. Burndy
5. Ortronics/Legrand
6. Erico

## 2.2 GROUNDING/EARTHING AND BONDING

### A. General:

1. Conductors: Provide copper grounding/earthing conductors.
2. Lugs, grounding strips, and busbars: UL Listed.
3. Fabricate with premium quality tin-plated electrolytic copper, providing low electrical resistance while inhibiting corrosion.
4. Provide antioxidant for field- bonding connections.
5. Lugs: NEBS Level 3. Provide two-hole lugs with irreversible compression and inspection windows, certified for use in non-corrosive environments so that connections may be inspected for full conductor insertion.
6. Die index numbers: Embossed on compression connections to allow crimp inspection.
7. Cable assemblies: UL Listed and CSA Certified.
  - a. Cables: Green or green/yellow.
  - b. Jackets: UL Listed, VW-1 flame rated.

- B. Telecommunications Bonding Backbone (TBB): A cable used to ground/earth PBB. Connect PBB to SBB; comply with J-STD-607-D guidelines and provide gauge not lighter than the following:

### C.

Table 1 – TBB/BBC/TBC conductor size vs length	
TBB Length in Linear meters (feet)	TBB Size (AWG)
Less than 4 (13)	6
4 - 6 (14 - 20)	4
6 - 8 (21 - 26)	3
8 - 10 (27 - 33)	2
10 - 13 (34 - 41)	1
13 - 16 (42 - 52)	1/0
16 - 20 (53 - 66)	2/0
20 - 26 (67-84)	3/0
26 - 32 (85 - 105)	4/0
32 - 38 (106 - 125)	250 kcmil
38 -46 (126 - 150)	300 kcmil
46 - 53 (151 - 175)	350 kcmil
53 - 76 (176 - 250)	500 kcmil
76 - 91 (251 - 300)	600 kcmil
Greater than 91 (301)	750 kcmil

### D. Sizing the Telecommunications Bonding Conductor (TBC)

1. The TBC shall be, as a minimum, the same size as the largest TBB.

### E. Sizing the Backbone Bonding Conductor (BBC)

1. The BBC shall be, as a minimum, the same size as the largest TBB to which it is connected.



F. Structural metal

1. The bonding conductor from the structural metal to the PBB or SBB shall be sized according to Table 1. Additionally, this conductor should be no smaller than any conductor that comprises the telecommunications bonding backbone system. Bonds to structural metal shall be made using listed exothermic welding, listed compression connections, or listed mechanical connectors and shall be accessible.

G. Telecommunications Equipment Bonding Conductor (TEBC): A cable used from the PBB or SBB to Rack and Rack Bonding Busbar (RBB) – minimum Size 6AWG.

H. Bonding Cable, Typical: For applications other than TBB, TEBC and BBC, provide gauge not lighter than the following:

I.

Table 2- Cable Sizes for Other Grounding/Earthing Applications	
Purpose	Copper Code Cable Size
Aisle grounds (overhead or under floor) of the common bonding network	#2 AWG or larger (1/0 preferred)
Bonding conductor to each PDU or panel board serving the room.	Size per NEC 250.122 & manufacturer recommendations
Bonding conductor to HVAC equipment	6 AWG
Building columns	4 AWG
Cable ladders and trays	6 AWG
Conduit, water pipe, duct	6 AWG

## 2.3 COMPONENTS, KITS AND HARDWARE

- A. Provide BICSI/J-STD-607-D telecommunications Primary Bonding Busbar PBB. Locate PBB at the telecommunications entrance room.
- B. Provide BICSI/J-STD-607-D Telecommunications Bonding Conductor (TBC) from the telecommunications entrance room to the AC service entrance. Bonds to AC service entrance shall be made using listed exothermic welding, listed compression connections, or listed mechanical connectors and shall be accessible.
- C. Provide BICSI/J-STD-607-D telecommunications Secondary Bonding Busbar (SBB) at typical telecommunications/equipment spaces throughout the building.
1. Provide additional SBB's as needed for number of termination points within each telecommunications/equipment space or upsize the SBB to a PBB.
  2. Multiple SBB's within a room shall be bonded together with a conductor the same size as the TBB or with splice bars.
- D. Provide BICSI/J-STD-607-D telecommunications Rack Bonding Busbar (RBB) at rack and cabinet locations.
- E. Provide compression type two-hole lugs for connecting conductors to PBB, SBB and RBB.

## PART 3 - EXECUTION

### 3.1 ROUTING TBB, TBC AND SBB

- A. Route the TBB to each SBB in as straight a path as possible. The TBB should be installed as a continuous conductor, avoiding splices where possible. When more than one TBB is used, bond them together on the top floor and every third floor in-between with a conductor known as a Backbone Bonding Conductor (BBC). When sizing the BBC, it must be at least the same size as the largest TBB.
- B. Bend The inside bend radius of telecommunications bonding conductors terminated at the primary bonding busbar (PBB) or secondary bonding busbar (SBB) shall have an inside bend radius of 200 mm (8 in). At other locations, bends in the bonding conductors should be limited to the greatest practical inside bend radius with a minimum bend radius of 10 times the bonding conductor diameter recommended. In all cases, the minimum bend radius angle shall be 90° or greater.
- C. Avoid routing grounding/earthing conductors in metal conduits. If the grounding/earthing conductor must be routed through a metal conduit, bond each end of the conduit to the grounding/earthing conductor. Use grounding clamps to bond to the conduit and #6 AWG copper conductor to connect the grounding clamp to the TBB.

### 3.2 RACK GROUNDING/EARTHING

- A. Bonding Equipment and Racks: Comply with BICSI/J-STD-607-D.
- B. To provide electrical continuity between rack elements, use paint piercing grounding washers where rack sections bolt together, on both sides, under the head of the bolt, and between the nut and rack.
- C. Utilize full-length rack ground strips attached to the rear of the side rail with thread-forming screws provided to ensure metal-to-metal contact.
- D. Mount an electrostatic discharge (ESD) port kit, directly to the Rack Bonding Busbar. Mount a second electrostatic discharge (ESD) port kit directly to the vertical mounting rail of the rack in the front at approximately the same height. Use the thread-forming screws provided to form a bond to the rack.
- E. When the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. Use the appropriate jumper for the equipment being installed and the thread-forming screws provided in the kit.
- F. Do not bond racks or cabinets serially.
- G. Bond patch panels to racks using bonding screws.
- H. Patch panels for shielded cabling shall be bonded to the telecommunications bonding system in accordance with manufacturer instructions

### 3.3 TESTING

- A. Perform continuity testing measurements of the grounding system with resistance to not exceed 0.1 ohm between:
  - 1. The PBB and the nearest grounding electrode.
  - 2. Each SBB and the nearest grounding electrode.
  - 3. Each SBB and pathway(s), rack(s), cabinet(s), and applicable equipment.

### 3.4 GROUNDING SYSTEM

- A. Communications grounding system: Comply with ANSI/TIA-942 and ANSI/TIA-607-D.
- B. Connection to Building ground/earth: Ensure connection is made by a licensed, electrical Installer, including installation and termination of the main bonding conductor to the building service entrance ground.
- C. Bond PBB to building steel; ground/earth to electrical service ground. Comply with BICSI TDM Manual and ANSI/TIA-607-D guidelines.
- D. Utilize UL listed exothermic two-hole lugs to make connections to the primary bonding busbar (PBB).

END OF SECTION 27 05 26

**SECTION 27 05 28 – LOW VOLTAGE CONDUIT SYSTEM****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for requirements which are applicable to this section.

**1.02 WORK INCLUDED**

- A. Provide labor, material, and supervision necessary to install all service and distribution as outlined in this section.

**PART 2 - PRODUCTS****2.01 WALL BOXES - TELEPHONE**

- A. Single gang galvanized steel with single gang device ring and wall plates.
- B. Modular jack to accept phone system wiring with two RJ-11 connectors.

**2.02 WALL BOXES - DATA**

- A. Single gang galvanized steel with single gang device ring and wall plates.
- B. Face plate to accommodate data system wiring.

**2.03 WALL BOXES - TELEPHONE AND DATA**

- A. Double gang galvanized steel with steel divided raceway.
- B. Double face plate with modular RJ-11 jacks for telephone and 2 data outlet grommets.
- C. Two raceways to accessible ceiling space.

**2.04 WALL BOXES – CATV**

- A. Single gang galvanized steel with single gang device ring and wall plate.
- B. Face plate to accommodate "F" type connectors.

**2.05 CONDUIT**

- A. 3/4" EMT from boxes to accessible ceiling space.
- B. Two 4" conduits from backboard through building foundation to exterior of the building, with pull wires.
- C. Provide 4" conduit raceway from Demarcation Room to Auxiliary Rooms on each floor.

**2.06 PLYWOOD BACKBOARDS**

- A. Furnish and install 3/4" thick marine grade plywood backpanels of the size and location where indicated.
- B. Install as a minimum a standard quad outlet and an isolated ground outlet at each location.
- C. Install a ground bar and insulated ground cable back to the building electrical service entrance ground.

### **PART 3 - EXECUTION**

#### **3.01 CONDUIT SYSTEM**

- A. Provide and install where indicated for the device being installed.
- B. Provide pull wire in empty conduit.
- C. Provide ground for system.
- D. Provide 120 volt quad receptacle at telephone backboard.
- E. Provide a 3/4 " thick marine plywood telephone backboard where indicated for use by the Telephone Company for the mounting of equipment.

END OF SECTION

## SECTION 27 05 28.36 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Continuous, rigid, welded steel wire mesh cable tray system used in industrial, commercial, and telecommunications applications
- B. Cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories.

#### 1.2 RELATED DOCUMENTS

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

#### 1.3 SUMMARY

##### A. Related Sections:

- 1. Comply with Section 27 10 00, "Telecommunications Structured Cabling," for voice and data cabling associated with system panels and devices.

##### B. Bidding Requirements:

- 1. Submit complete detailed proposals with line item cost representation for components and associated installation labor. Lump sum bids will not be accepted.
- 2. Include as part of the bid response the following items:
  - a. Installation schedule with proposed manpower assignments.
  - b. Resumes for project manager and lead technician for this project.
- 3. Review associated electrical, audiovisual, and telecommunications infrastructure drawings to verify that necessary conduit and boxes will be provided. Understand and coordinate shared infrastructure locations for AV and voice/data outlets. No additional infrastructure to support the telecommunications cabling systems (inside plant/outside plant) will be provided. Any discrepancies with the identified infrastructure to support these systems should be questioned in the form of a request for information (RFI) during the bidding process. Be responsible for any additional infrastructure requirements after receipt of contract for this project.
- 4. No wiremold or surface mounted raceways shall be approved on this project except where explicitly identified.

#### 1.4 REFERENCES

- A. IEC 61537 (2006) – Cable Tray Systems and Cable Ladder Systems for Cable Management
- B. NEMA VE 1-2017/CSA C22.2 No. 126.1-17 – Metal Cable Tray Systems
- C. ANSI/NFPA 70 – National Electric Code (NEC)

- D. TIA 569-D (2015) – Commercial Building Standard for Telecommunications Pathways & Spaces
- E. ASTM A 510 - Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
- F. ASTM A 380 – Specification for Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
- G. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- H. ASTM A 123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- I. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
- J. Norm NF/A 91-131 for Galvanized Steel
- K. Norm NF/EN 12-329 for Electrocoat
- L. Norm NF/EN/ISO 14-61 for Hot-Dipped Galvanized Steel
- M. Norm NF 10-088-2 for Stainless Steel

#### 1.5 SYSTEM DESCRIPTION

- A. This section outlines the performance for the noted cable tray support systems, as indicated on the low voltage drawings. The tray system shall provide a common raceway for telecommunications cable into and out of the Telecommunications Rooms (TR). Cable tray systems shall also be installed above finished ceiling in the common area hallways that are located on all floors of the building. The common area cable tray is intended to support telecommunications cabling from any of the station cable wall/floor outlet locations on any floor. Each station cable wall/floor outlet shall have a configuration of conduit pipe run to the tray system to support the aforementioned station cabling. It is intended to have this tray system transition (via a Cable Dropout or Runway Radius Drop) into the ladder tray installed above the noted equipment racks within the TR's.

#### 1.6 DESIGN REQUIREMENTS

- A. Maximum Deflection between Supports: L/240

#### 1.7 SUBMITTALS

##### A. Related Sections

1. Comply with requirements of Section 01 33 00, "Submittal Procedures."

##### B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
  - a. Cover Sheet
    - 1) Include name of supplying contractor and project name.
    - 2) Include submittal and revision number.
  - b. Detailed Bill of Materials

- 1) Include a listing of: component quantities, equipment manufacturers, model numbers, descriptions of each component being supplied, and the specification paragraphs or drawing sheets that correspond to each product.
- 2) The bill of materials shall be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
- 3) Failure to provide this information will result in the rejection of submittals.
- c. Product Data
  - 1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
  - 2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed if they provide adequate clarity of both the printed word and graphics/pictures.
  - 3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight. All optional components and selections shall be clearly indicated.
- d. Prequalification Certificate.
  - 1) Copy of the installing technician(s) certificate of completion from the manufacturer's training school for the equipment being provided.
- e. Manufacturer Qualifications
  - 1) Submit manufacturer's certification indicating ISO 9002 quality certified.
- f. Design Calculations
  - 1) Verify loading capacities for supports.
- g. Submit Factory-certified test reports of specified products, complying with IEC 61537, NEC, and NEMA VE 1/CSA C22.2 No. 126.1.

#### C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
  - a. Title Sheet with sheet index and symbols legend
  - b. Coordination Drawings: Include floor plans and sections drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural and mechanical elements. Data presented on these drawings are as accurate as preliminary surveys and planning can determine. Field verification of all dimensions, routing, etc., is directed.
  - c. Cable Tray Drawings: Submit drawing indicating materials, finish, dimensions, and accessories. Show layout, support, and installation details.
2. Drawings should be at project standard scale and clearly legible.
3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

#### D. Form

1. Submit all materials for review as described above, specifically referenced to the specification paragraph number (where applicable).
  - a. Submit all drawings on sheets of one size, preferably the project standard size.
  - b. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.
2. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following submittals shall not be considered partial:



- a. Personnel
- b. Milestones
- c. Conduit Verification Statement and Notifications
- d. Rigging and Mounting Drawings
- e. As-Built Documentation

3. Product Data and shop drawings must be submitted together in order to be reviewed.

## 1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.
- B. Manufacturer Qualifications: ISO 9002 quality certified
- C. Comply with NFPA 70. National Electrical Code, Article 392: Cable Trays; provide UL Classification and labels.
- D. Provide ETL test documentation showing cable compression/deformation testing.

## 1.9 COORDINATION

- A. Coordinate layout and installation of cable tray with other installations.
  - 1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.
- B. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage. Protect materials and finishes during handling and installation to prevent damage
- C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  - 1. Cablofil, Inc. (Basis of design)
  - 2. NVent/WBT
  - 3. Bline
  - 4. Chatsworth
  - 5. Snake Tray
  - 6. approved equal.

## 2.2 CABLE TRAY SYSTEM

- A. Description: Cablofil EZ Tray continuous, rigid, welded steel wire mesh cable tray system
  - 1. Mesh System: Permits continuous ventilation of cables and maximum dissipation of heat
  - 2. Safety Edge: Continuous safety edge T-welded wire lip
  - 3. Wire Mesh: Welded at all intersections
- B. UL Classification: Straight sections 4 x 8, 12, 18 and 24 inches (108 x 200, 300, 450, and 600 mm), UL classified. Width of tray shall be determined based on not exceeding industry standards for fill ratios.
- C. Material: Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture
- D. Finish for Carbon Steel Wire: Finish applied after welding and bending of mesh
  - 1. Electro-Plated Zinc Galvanizing: ASTM B 633, Type III, SC-1
  - 2. Hot-Dip Galvanizing: ASTM A 123
- E. Nominal Dimensions:
  - 1. Mesh: 2 x 4 inches (50 x 100 mm)
  - 2. Straight Section Lengths: 80 inches (2,000 mm) and 118 inches (3,000 mm)
  - 3. Width: Cable tray widths shall be selected based on cable density. No tray shall exceed 50% manufacturer's stated capacity at time of initial installation.
    - a. 2 inches (50 mm)
    - b. 4 inches (100 mm)
    - c. 6 inches (150 mm)
    - d. 8 inches (200 mm)
    - e. 12 inches (300 mm)
    - f. 18 inches (450 mm)
    - g. 24 inches (600 mm)
  - 4. Depth: 4 inches (108 mm)
  - 5. Wire Diameter: 0.177 inch (4.5 mm), minimum
- F. Fittings: Field fabricated in accordance with manufacturer's instructions from straight sections
- G. Support System: Standard
  - 1. Wall Installation: CS Bracket. Maximum tray width of 12 inches (300 mm)
  - 2. Trapeze Mounting to Ceilings: CS Profile. Maximum tray width of 18 inches (450 mm)
  - 3. Ceiling Installation: CSC Bracket. Maximum tray width of 12 inches (300 mm)
  - 4. Fasteners: As required by tray widths. Furnished by manufacturer.

#### H. Support System: Caloric FAS System

1. Floor and Wall Installation: FAS Profile
  2. Wall Installation:
    - a. FAS Universal Bracket. Maximum tray width of 24 inches (600 mm)
    - b. FAS L Bracket. Maximum tray width of 12 inches (300 mm)
  3. Ceiling Installation: FAS C Bracket. Maximum tray width of 12 inches (300 mm)
  4. Fasteners: Not required
- I. Hardware: Hardware, including splice connectors and support components, shall be furnished by the manufacturer.

### 2.3 ACCESSORIES

- A. Shielding Divider Strips: Divider strips to follow contour of cable tray run for shielding to run power and control cables in same tray. Pre-galvanized steel, [4 x 1-1/2 inches (108 x 30 mm)]
- B. Fittings: Provide tees, crosses, risers, elbows, radius tees, and other fittings as indicated, of the same materials and finishes as cable tray.
- C. Grounding: Provide GNDSB grounding lugs for attachment on tray of continuous ground conductor fixing system.

### 2.4 FIRE STOP CABLE PASS-THRU SLEEVES

- A. Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  1. Basis of design: Specified Technologies Inc.
  2. Approved equal by:
    - a. 3M Corporation
    - b. Hilti Corporation
    - c. Wiremold- Legrand Corporation
- B. Fire Rated Cable Pathways: Provide STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. The following products are acceptable:
  1. Specified Technologies Inc. (STI) EZ-PATH Series 44 Fire Rated Pathway
  2. Specified Technologies Inc. (STI) EZ-PATH Series 33 Fire Rated Pathway

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Exam areas to receive cable management system. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the system. Do not proceed with installation until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. Install cable tray level and plumb according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Install cable management system at locations indicated on the drawings and in accordance with manufacturer's instructions. Install the cable tray system directly above the racks positioned within the space to allow for ease in cable management to and from the racks. Provide firestopping at penetration into/out of all telecommunications rooms.
- C. Load Span Criteria: Install and support cable management system in accordance with span load criteria of L/240.
- D. Cutting:
  - a. Cut cable tray wires in accordance with manufacturer's instructions.
  - b. Cable tray wires must be cut with side-action bolt cutters with offset head to ensure integrity of protective galvanic layer.
  - c. Remove burrs and sharp edges from cable trays.
- E. Install cable management system using hardware, splice connectors, support components, and accessories furnished by manufacturer.
- F. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed 90 feet.
- G. Ground cable tray according to manufacturer's written instructions.
- H. The cable tray and ceiling installation shall allow for re-entry to accommodate additional cable to be pulled from all occupied spaces to their respective IDF locations on each floor. Provide the following clearance for all installation locations.
  - 1. A minimum of 3" clear vertical space between ceiling tile and cable tray.
  - 2. A minimum of 8" access headroom above the cable tray system
  - 3. Enough clearance on both sides of the tray to maintain accessibility with a human hand.
- I. Provide bend limiters to maintain cable type bend radius whenever cable exists cable tray into TR rooms.
- J. Provide radius kits at all 90-degree turns.
- K. Certified Installers: Cable tray installers must have successfully completed Cablofil's Certified Installer program.

### 3.3 FIRESTOPPING

- A. Firestopping In Telecommunications Room at Cable Tray Entrance
  - 1. Install EZ Path Series 44 as shown on contract drawings.
- B. Firestopping where cable tray passes through a rated wall assembly.
  - 1. Install quantity of EZ Path series 33 or series 44 to 100% fill ratio of the size of cable tray at entrance to opening.

- C. General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
- D. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.

END OF SECTION 27 05 28.36

## SECTION 27 05 28.45 - TELECOMMUNICATIONS FLUSH POKE-THRU DEVICE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Telecommunications cabling poke-thru
- B. Related Sections include the following:
  - 1. Division 09 Sections for Floor Coverings
  - 2. Division 26 Electrical Sections
  - 3. Division 27 Telecommunications Systems

#### 1.2 PERFORMANCE REQUIREMENTS

- A. General: These poke-thru devices provide the interface between power, communication and audio/ visual (A/V) cabling in an above grade concrete floor and the workstation or activation location where power communication and/or A/V device outlets are required. These poke-thru devices provide recessed device outlets that will not obstruct the floor area.
  - 1. ADA Compliance: Flush-mounted floor device outlets shall not create tripping hazards.
- B. Floor Mounted Connector Assembly: These poke-thru devices provide flush device outlets that will not obstruct the floor area.
- C. Labeling: Floor boxes shall bear the "cULus mark" issued by UL for units complying with both US and Canadian Standards.
- D. Classification and use.
  - 1. This poke-thru device shall have been examined and tested by Underwriters Laboratories Inc. to Standard UL514A and/or UL514C and Canadian Standard C22.2, No. 18-98 and bear the U.S. and Canadian UL Listing Mark. This poke-thru device shall also have been tested by Underwriters Laboratories Inc. and classified for fire resistance and bear the U.S. and Canadian UL Classification Mark. Devices shall be classified for use in 1-, 1 1/2-, or 2-hour rated, unprotected reinforced concrete floors and 1-, 1 1/2-, or 2-hour rated floors employing unprotected steel floor units and concrete toppings (D900 Series Designs) or concrete floors with suspended ceilings (fire resistive designs with suspended ceilings should have provisions for accessibility in the ceiling below the poke-thru fittings. This device shall also conform to the standards set in the National Electric Code, Section 300-21. These devices meet all UL scrub water requirements, but are not suitable for wet or damp locations, or other areas subject to saturation with water or other liquids such as commercial kitchens. This poke-thru device shall also have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors. Suitable for use in air handling spaces in accordance with Sec 300-22 (C) of the National Electrical Code.
  - 2. Standards: Comply with the following:

3. UL514A and/or UL514C and Canadian Standard C22.2, No. 18-98 and bear the U.S. and Canadian UL Listing Mark
4. National Electrical Code

### 1.3 SUBMITTALS

#### A. Related Sections

1. Comply with requirements of Section 01 33 00, "Submittal Procedures."

#### B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
  - a. Cover Sheet
    - 1) Include name of supplying contractor and project name.
    - 2) Include submittal and revision number.
  - b. Detailed Bill of Materials
    - 1) Include a listing of: component quantities, equipment manufacturers, model numbers, descriptions of each component being supplied, and the specification paragraphs or drawing sheets that correspond to each product.
    - 2) The bill of materials shall be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
    - 3) Failure to provide this information will result in the rejection of submittals.
  - c. Product Data
    - 1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
    - 2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
    - 3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight. All optional components and selections shall be clearly indicated.
  - d. Authorized Distributor Certificate
    - 1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.
  - e. Informational Submittals:
    - 1) Manufacturer's installation instructions
  - f. Submittal shall be a single PDF file.
    - 1) Partial submittals, or submittals comprised of multiple PDF files, will be rejected.

#### C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
  - a. Title Sheet with sheet index and symbols legend
  - b. All panels, plates, and designation strips, including connectivity, layout, labeling, and details relating to terminology, engraving, finish and color
  - c. All unusual equipment modifications
  - d. Equipment location drawings
  - e. Floor plans showing poke-thru locations based on column grid lines.

2. Drawings should be at project standard scale and clearly legible.
3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

D. Form

1. Submit all materials for review as described above, specifically referenced to the specification paragraph number (where applicable).
  - a. Submit all drawings on sheets of one size, preferably the project standard size.
  - b. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.
2. Product Data and shop drawings must be submitted together in order to be reviewed.

## PART 2 - PRODUCTS

### 2.1 POKE THRU DEVICE

- A. Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
1. Wiremold, Legrand
  2. Hubbell Premise Wiring
  3. Approved equal
- B. The same manufacturer shall provide all poke-thru types for the project.

### 2.2 MATERIALS 6AT POKE-THRU ASSEMBLY.

1. This assembly consists of an insert and an activation cover. Overall poke-thru assembly length shall be 16 3/4" [425mm].
- B. Insert
1. The insert body shall recess the devices a minimum of 2 3/4" [69 mm] and have a polyester based backing enamel finished interior (ivory). There shall be the necessary channels to provide complete separation of power and communication services. There shall be three compartments two side compartment for duplex receptacles that can be wired as a standard receptacle or isolated ground and on center compartment that can accommodate up to eight communication ports.
  2. The body will consist of an intumescent fire stop material to maintain the fire rating of the floor slab. The intumescent material will be held securely in place in the insert body and shall not have to be adjusted to maintain fire rating of the unit and the floor slab. The insert shall have retaining feature that will hold the poke-thru device in the floor slab without additional fasteners. The poke-thru insert shall also consist of a 3/4" trade size conduit stub that is connected to the insert body and a 24.5 cu. in. [402ml] stamped steel junction box for wire splices and connections. The stamped steel junction box shall also contain the necessary means to electrically ground the poke-thru device to the system ground.
- C. Activation Cover:



1. The activation covers shall be manufactured of die-cast aluminum alloy and be available in powder-coated gray, black, or plated in brass, nickel or bronze finish. Two gaskets (one for carpet and one for tile) are provided to go under the trim flange to maintain scrub water tightness. The activation cover shall be 7 1/4" [184mm] in diameter. The activation covers shall be available in carpet and tile versions. The carpet covers shall be surface mounted and the tile covers shall be flush with the finished floor covering. The cover shall have spring loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible.

D. Communication Modules Mounting Accessories:

1. The activation shall have one location to mount communication connectors. Connectors shall be mounted using a mounting bracket. Mounting brackets shall be provided to mount up to eight Ortronics TracJack Category 6 insert modules or Category 3. 5e. or 6 keystone connectors. The unit shall also accommodate a mechanism to permit protection of communication cabling. This mechanism shall be stamped steel construction and accept both flexible and rigid conduit. This mechanism shall accept 3/4", 1-1/4" or 2" trade size conduits.

E. Provide pull strings in each conduit at poke thru location.

- F. The floor box manufacturer shall have available a complete line of workstation connectivity outlets and modular inserts, and Connectivity Modular Inserts for UTP, Fiber Optic, Coaxial, and other cabling types with faceplates and bezels to facilitate mounting.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. With Installer present, verify that manufacturer's requirements for floor opening and infrastructure conditions have been satisfactorily met. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Arrange for jobsite approval of the equipment prior to commencing installation.
- B. Verify exact locations of poke-thru installation.

#### 3.3 INSTALLATION

- A. Install equipment in compliance with approved shop drawings and manufacturer's installation instructions.
- B. Unit shall permit all wiring to be completed at floor level. The 6AT unit shall mount in a 6" [152mm] cored hole, actual 6 1/16" [154mm] core hole.
- C. Use is defined by the UL Fire Resistance Directory as a minimum spacing of "2 ft. [610mm] on center and not more than one device per each 65 sq. ft. [6m2] of floor area in each span."
- D. Installation shall be completed by pushing unit down into the cored hole. Prior to and during installation, refer to system layout and/or approval drawings. Installer shall comply with detailed manufacturer's instruction sheet included with each device. The unit shall contain a retainer for securing the device in the slab, as well as the necessary intumescent material to seal the cored hole under fire conditions.

E. The trim flange color and texture is to be coordinated with architect.

3.4 COPPER CROSS SECTIONAL AREA

A. The maximum copper cross sectional area for the 6AT outer compartment only is .0154 sq. in. [9.9 mm<sup>2</sup>]. The maximum copper cross sectional area for the center compartment only is .0387 sq. in. [24.9mm<sup>2</sup>].

3.5 ADJUSTING

A. Adjust poke-thru for proper operation.

3.6 PROTECTION

A. Protect installed equipment in original undamaged condition until Substantial Completion. Remove and provide new components or units that cannot be repaired to the satisfaction of the Architect.

END OF SECTION 27 05 28.45

## SECTION 27 05 28.48 - MULTIMEDIA CONNECTION WALL BOX

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Multimedia Connection Wall Box

B. Related Sections include the following:

1. Division 27 Telecommunications Systems, Audiovisual Systems, wiring, connections, and installation of associated conduit infrastructure

#### 1.2 PERFORMANCE REQUIREMENTS

A. General: Wall boxes provide an interface between power and telecommunication cabling in a wall mount flat panel display locations requiring power and/or communication device outlets.

B. Wall Mounted Connector Assembly: Rubber cable pass thru door and cover assembly along with connector mounting panel inserts

C. Labeling: Wall boxes shall bear the "cULus mark" issued by UL for units complying with both US and Canadian Standards.

D. Standards: Comply with the following:

1. National Electrical Code

#### 1.3 SUBMITTALS

A. Related Sections

1. Comply with requirements of Section 01 33 00, "Submittal Procedures."

B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:

a. Cover Sheet

- 1) Include name of supplying contractor and project name.
- 2) Include submittal and revision number.

b. Detailed Bill of Materials

- 1) Include a listing of: component quantities, equipment manufacturers, model numbers, descriptions of each component being supplied, and the specification paragraphs or drawing sheets that correspond to each product.
- 2) The bill of materials shall be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
- 3) Failure to provide this information will result in the rejection of submittals.

c. Product Data

- 1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet

shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.

- 2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
  - 3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight. All optional components and selections shall be clearly indicated.
  - d. Authorized Distributor Certificate
    - 1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.
  - e. Partial submittals, or submittals comprised of multiple PDF files, will not be accepted.
2. Informational Submittals:
- a. Manufacturer's installation instructions

#### C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
  - a. Title Sheet with sheet index and symbols legend
  - b. All panels, plates, and designation strips, including connectivity, layout, labeling, and details relating to terminology, engraving, finish and color
  - c. All unusual equipment modifications
  - d. Equipment location drawings
  - e. Detailed riser drawing indicating conduit runs and associated (box knockout) cables within
  - f. Floor plans showing Wall box locations based on column grid lines
2. Drawings should be at project standard scale and clearly legible.
3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

#### D. Form

1. Submit all materials for review as described above, specifically referenced to the specification paragraph number (where applicable).
  - a. Submit all drawings on sheets of one size, preferably the project standard size.
  - b. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.
2. Product Data and shop drawings must be submitted together in order to be reviewed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  1. FSR

2. Approved equal

B. Model PWB-100 Wall Box:

1. Box shall be:

- a. Manufactured from 14-gauge steel approved for use in new and renovation construction locations.
- b. Polyester based backed enamel finished interior (white).
- c. Provided with two (2) independent wiring compartments.
- d. Able to work with 1/2" or 5/8" dry wall.
- e. Box to be able to be installed between 16" on center metal or wood studs.
- f. Able to accept 2-3/4" x 4-1/2" standard size wall plates.

C. Overall box dimensions shall be as follows:

- 1. 11" W x 5.25" H x 3.57" D.

2.2 COVER

A. PWB-100-WHT - White Cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. With Installer present, verify that manufacturer's requirements for wall opening and infrastructure conditions have been satisfactorily met. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Verify exact locations of Wall box installation.

3.3 INSTALLATION

A. Install equipment in compliance with approved shop drawings and manufacturer's installation instructions.

B. Install in position and relationship to adjoining work indicated, securely anchored to supporting structure, sealed and finished, and in a manner, which produces a level box with square, plumb, and straight edges.

C. Telecommunications Cabling Wall box shall have a total of three separate EC with pull string at each box as follows:

- 1. One 3/4-inch EC from box to circuit panel. (Duplex AC Power)
- 2. Two 1-1/4 inch EC from box to telecom cable tray A.F.C. One conduit run to lower Low voltage backbox and one conduit run to the upper Low voltage backbox.

D. Provide pull strings in each conduit at wall box location.

3.4 ADJUSTING

A. Adjust door and cover for proper operation.

### 3.5 PROTECTION

- A. Protect installed equipment in original undamaged condition until Substantial Completion. Remove and provide new components or units that cannot be repaired to the satisfaction of the Architect.

END OF SECTION 27 05 28.48

## SECTION 27 10 00 - TELECOMMUNICATIONS STRUCTURED CABLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 REFERENCES

- A. Building Industry Consulting Services International (BICSI), "Telecommunications Distributions Methods Manual," Fifteenth Edition
- B. American National Standards Institute/Telecommunications Industry Association (ANSI/TIA) - 568.2-D, "Commercial Building Telecommunications Wiring Standard"
- C. ANSI/TIA-569-E, "Commercial Building Standard for Telecommunications Pathways and Spaces"
- D. ANSI/TIA-606D, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"
- E. ANSI/TIA-607-D, "Commercial Building Grounding/Bonding Requirements"
- F. National Electrical Code (NEC), 2020 - National Fire Protection Agency (NFPA) 70
- G. Institute of Electrical and Electronic Engineers (IEEE) 802.3 Carrier Sense Multiple Access with Collision Detection (Ethernet 10/100/1000/10000 BASE-T)
- H. Federal Communications Commission (FCC), Title 47, Code of Federal Regulations, Part 68
- I. National Institution for Certification in Engineering Technologies (NICET)
- J. Audiovisual and Integrated Experience Association (AVIXA).

#### 1.3 SUMMARY

- A. Section Includes:
  - 1. UTP cabling
  - 2. Optical fiber cabling
  - 3. Multi-pair copper cable
  - 4. Coaxial cable (radio frequency video)
  - 5. Cable connecting hardware, patch panels, and cross-connects
  - 6. Telecommunications outlet/connectors
  - 7. Cable management system

8. Cabling identification products
9. Backboards
10. Telecommunications equipment racks and cabinets
11. Telecommunications service entrance pathways
12. Grounding and bonding
13. Telecommunications Pathways
14. Telecommunications mounting elements

B. Related Sections:

1. Division 27 05 26, "Grounding and Bonding for Communications Systems," for voice and data cabling associated with system panels and devices
2. Division 27 05 28.36, "Cable Trays for Communications Systems," for voice and data cabling associated with system panels and devices

C. Bidding Requirements:

1. Bidder shall submit complete detailed proposals with line item cost representation for components and associated installation labor. Lump sum bids will not be accepted.
2. Bidders shall include as part of the bid response the following items:
  - a. Installation schedule with proposed manpower assignments
  - b. Resumes for project manager and lead technician for this project
  - c. BICSI RCDD certificate and registration number
3. Bidders shall review associated architectural, electrical, and telecommunications infrastructure drawings to verify that necessary conduit and floor boxes will be provided by others. Bidders shall understand and coordinate shared infrastructure locations for telecommunications outlets. The Owner will provide no additional infrastructure to support the telecommunications cabling systems Inside Plant (ISP) and Outside Plant (OSP). Any discrepancies with the identified infrastructure to support these systems should be questioned in the form of a request for information (RFI) during the bidding process. Be responsible for any additional infrastructure requirements after receipt of contract for this project. No wiremold or surface mounted raceways shall be approved on this project except where specifically identified in the contract drawings.
4. Unspecified Equipment and Material: Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional Structured Cabling System shall be provided in a level of quality consistent with other specified items.

1.4 DEFINITIONS

- A. AFC: Above Finished Ceiling
- B. BICSI: Building Industry Consulting Service International



- C. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways
- D. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection
- E. EF: Entrance Facility
- F. EMI: Electromagnetic interference
- G. HC: Horizontal Cross Connect
- H. IDC: Insulation displacement connector
- I. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs)
- J. LAN: Local Area Network
- K. MC: Main Cross-connect
- L. MPTL: Modular Plug Terminated Link
- M. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors
- N. NRTL: Nationally Recognized Testing Laboratory
- O. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates
- P. RCDD: Registered Communications Distribution Designer
- Q. TR: Telecommunications Room

## 1.5 SYSTEM DESCRIPTION

- A. Provide a complete and functioning Structured Cabling System inclusive of all hardware, software, and training to meet or exceed the performance features outlined in this document.
- B. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
  - 1. ANSI/ANSI/TIA-568.2-D requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  - 2. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
  - 3. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  - 4. Bridged taps and splices shall not be installed in the horizontal cabling.

- 5. Splitters shall not be installed as part of the optical fiber cabling.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.
- D. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- E. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.
- F. Communications equipment room shall provide the space to house the equipment for the backbone and horizontal cabling.

#### 1.6 PERFORMANCE REQUIREMENTS:

- A. General Performance: The cabling system shall comply with transmission standards in ANSI/TIA-568.2-D and ANSI/TIA-568.3-D when tested according to the test procedures of this standard.

#### 1.7 SUBMITTALS

- A. Comply with requirements of Section 01 33 00, "Submittal Procedures."

- B. Submittal Data

- 1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
  - a. Cover Sheet
    - 1) Include name of supplying contractor and project name.
    - 2) Include submittal and revision number.
  - b. Detailed Bill of Materials
    - 1) Include a listing of component quantities, equipment manufacturers, model numbers, and descriptions of each component being supplied and the specification paragraphs or drawing sheets that correspond to each product.
    - 2) The bill of materials shall include page numbers for each product data sheet and be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
    - 3) Failure to provide this information will result in the rejection of submittals.
  - c. Product Data
    - 1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
    - 2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
    - 3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight.
  - d. Authorized Distributor Certificate

- 1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.
- e. Prequalification Warrantee
  - 1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is Authorized to obtain for the owner the Special Warranty for Cabling System and the Special Warranty for System Assurance.
- f. Prequalification Certificate
  - 1) Copy of the installing technician(s) certificate of completion from the manufacturer's training school for the equipment being provided.
- g. Submittal shall be a single PDF file.
  - 1) Partial submittals, or submittals comprised of multiple PDF files, will be rejected.

#### C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. Each shop drawing set is to include the below in the following order:
  - a. Title Sheet
    - 1) Include a list of all drawings in the set and a symbols legend defining each symbol used in the package.
  - b. Riser Diagram
    - 1) Show the relationship of TR's, the pathway between them, and cable connectivity to be installed.
  - c. Video/CATV System Engineering
    - 1) Depict device location by room number and device type. Delineate cable types and cable pathway for both riser and horizontal distribution. Calculate db loss and outline levels for each splitter, tap, amplifier, and outlet.
  - d. Telecommunications Room Details
    - 1) Plan Details of infrastructure and room fittings with clearances
    - 2) Elevation Details of wall fields and rack details showing the relationship of rack mounted elements inclusive of owner-provided equipment (labeled as such).
  - e. Typical Outlet Details
    - 1) Detail each typical outlet type to be installed. Include manufacturer specific plates, jacks, and an example of labeling. Note on the drawing the typical application of each outlet type, for example; standard office, computer lab, ceiling mounted wireless access location, etc.
  - f. Floor Plans
    - 1) Show planned location for all elements and cable routing.
    - 2) Include outlet port numbers for each outlet.
    - 3) Cable Schedule: Listing incoming and outgoing cables and their designations, origins, and destinations.
2. Drawings should be at project standard scale and clearly legible.
3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

D. Product data and shop drawings must be submitted together in order to be reviewed.

E. Samples shall be submitted for each typical outlet type to be installed, complete with colored jacks, finished faceplates, and sample labeling.

F. Field quality-control reports

1. Submit copy of project status reporting form.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 installer and manufactures certified installer, who shall be present at all times when work of this section is performed at project site. At a minimum, one half of remainder of the crew shall be registered technicians by the specified manufacturer as part of their Certified Installer Program.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less
  - 2. Smoke-Developed Index: 50 or less
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Installing company shall be certified by manufactures in aspects of design, installation and testing of optical and Category rated metallic premise distribution systems, be a manufactures Value Added Reseller (VAR) in good standing, have a minimum of five (5) years' experience on similar Structured Cabling Systems (SCS), and have a Registered Communications Distribution Designer (RCDD) on staff.
- E. Telecommunications Pathways and Spaces: Comply with ANSI/TIA-569-E.
- F. Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2017 ANSI/ANSI/TIA-606-C.
- G. Grounding: Comply with ANSI-J-STD-607-C.
- H. NFPA 70 – National Electric Code, latest edition
- I. BICSI – Telecommunications Distribution Methods Manual, Fourteenth Edition
- J. NEMA – VE-1 – Metal Cable Tray Systems, 2017
- K. NEMA – VE-2 – Metal Cable Tray Installation Guidelines, 2013

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test optical fiber cable to determine the continuity of the strand end to end. Use an optical loss test set.
  - 2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

3. Test each pair of UTP cable for open and short circuits.
- B. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

#### 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install equipment frames and ladder racking until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

#### 1.11 COORDINATION

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
  1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
  2. Record agreements reached in meetings and distribute them to other participants.
  3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
  4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- B. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- C. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.
- D. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

#### 1.12 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Patch-Panel Units: The greater of one (1) or 10% of total quantity of each type
  2. Connecting Blocks: The greater of one (1) or 10% of total quantity of each type
  3. Device Plates: The greater of ten (10) or 2% of total quantity of each type

## 1.13 WARRANTY

- A. Special Warranty for Cabling System: Manufactures warranty shall ensure against product defects; that approved cabling components exceed the specifications of ANSI/TIA-568.2-D, ANSI/TIA-568.3-D, and ISO/IEC IS 11801; exceed the attenuation and NEXT requirements of ANSI/TIA-TSB-67 and ISO/IEC IS 11801 for cabling links/channels; and that the installation will exceed the loss and bandwidth requirements of ANSI/TIA-TSB-67 and ISO/IEC IS 11801 for fiber links/channels. The warranty shall apply to passive SCS components.

1. Warranty Period: 25 - year Cabling System from date of Substantial Completion

- B. Special Warranty for System Assurance: Manufactures warranty shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that recognize ANSI/TIA-568.2-D, ANSI/TIA-568.3-D, or ISO/IEC IS 11801 component and link/channel specifications for cabling.

1. Warranty Period: 25 - year Applications Assurance from date of Substantial Completion

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PATHWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, and are limited to, the following:

1. Basis of design: nVent Caddy

2. Approved equals by:  
a. Eaton/B-line  
b. Hilti Inc.

- B. General Requirements: Comply with ANSI/TIA-569-E.

- C. Cable Support: NRTL labeled. Cable support brackets in Telecommunications Rooms shall be designed to prevent degradation of cable performance and pinch points that could damage cable.

- D. Provide bend limiters, if not built into the cable support, to maintain cable type bend radius whenever cable exists pathways or makes transition between two pathways.

- E. Non-continuous cable supports shall be used in any area above the finished ceiling where cable tray is not available.

- F. Bridle rings shall not be used for telecom cable support.

G. Non-continuous cable supports

1. Cable Support shall be NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
2. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
3. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
4. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
5. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
6. Non-continuous cable supports shall be NVent CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CMTM Double J-Hook CAT100CM; CAT-CMTM U-hook series CAT200CMLN, CAT300CMLN; and CAT-CMTM retainer CATRT200CM, CATRT300CM, or approved equal.

H. Adjustable non-continuous cable support sling

1. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair UTP; rated for indoor use in non-corrosive environments. Rated to support Category 5 and higher cable, or optical fiber cable; cULus Listed.
2. Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.
3. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.
4. If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips.
5. Acceptable products: NVENT CADDY CableCat™ CAT425 or approved equal.

I. Multi-tiered non-continuous cable support assemblies

1. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; cULus Listed.
2. If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.
3. The multi-tiered support bracket shall consist of NVENT CADDY CATHBA and CableCat™ J-Hooks with screws or approved equal.

J. Non-continuous cable support assemblies from drop wire/ceiling

1. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
  2. Acceptable products: NVENT CADDY CAT124Z34, CAT126Z34, CAT214Z34, CAT216Z34, CAT324Z34 or CAT326Z34, or approved equal.
- K. Non-continuous cable support assemblies from beam, flange
1. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
  2. Acceptable products: NVENT CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY beam clamps and CADDY flange clips, or approved equal.
- L. Non-continuous cable support assemblies from C & Z Purlin
1. Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus listed.
  2. Acceptable products: NVENT CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY Purlin hangers, or approved equal.
- M. Non-continuous cable support assemblies from wall, concrete, or joist
1. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus listed.
  2. Acceptable products: NVENT CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, with CADDY angle bracket, or approved equal.
- N. Non-continuous cable support assemblies from threaded rod
1. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.
  2. The multi-tiered support bracket shall have a static load limit of 300 lbs.
  3. U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.
  4. Acceptable products: NVENT CableCat™ J-hook, CAT12, CAT21, CAT32, CAT64 with CADDY CATHBA series; CAT-CMTM Double J-hook CAT100CM, CAT-CMTM Direct mount U-hook CAT200CMLN, CAT300CMLN; or AFAB series, or approved equal.
- O. Raised floor non-continuous cable support assemblies
1. Fastener to raised (access) floor pedestal with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments; cULus Listed.
  2. Acceptable products: NVENT CADDY CAT12CD1B, CAT21CD1B or CAT32CD1B; CAT64CD1B, or approved equal.
- P. Cantilever-Mounted cable supports
1. U-hook shall be able to be assembled to a wide variety of wall mount brackets.



2. Individual U-hooks shall be spaced as needed, maximum 5' apart.
3. U-hooks may have the optional attachment of a cable roller for ease in pulling cables.
4. Acceptable products: NVENT CAT-CMTM U-hooks CAT200CMLN, CAT300CMLN: CAT-CM roller assemblies CATRL200CM, CATRL300CM; CATWMCM bracket, or approved equal.

## 2.3 CONDUIT AND BOXES

- A. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceways and Boxes." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 5 inches wide, 5 inches high, and 2.875 inches deep.

## 2.4 UTP CABLE

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

1. Berk-Tek - Leviton
2. CommScope, Inc.
3. Mohawk; a division of Belden CDT
4. Superior Essex Inc.
5. SYSTIMAX Solutions; a CommScope, Inc. brand
6. Uniprise; a CommScope, Inc. brand
7. Hubbell Premise wire
8. General Cable Technologies Corporation
9. Belden, Inc.
10. Hitachi Cable America Inc.

- B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket

1. Comply with ANSI/TIA-568.2-D for performance specifications.
2. Comply with ANSI/TIA-568.2-D, Category 6A.
3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with and NFPA 70 for the following types:
  - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262

## 2.5 UTP CABLES - WIRELESS ACCESS POINT

- A. Manufacturers: Subject to compliance with requirements, provide cable product by the specified UTP cable manufacturer article "UTP CABLE".

- B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket
  - 1. Comply with ANSI/TIA-568.2-D for performance specifications.
  - 2. Comply with ANSI/TIA-568.2-D, Category 6A.
  - 3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with and NFPA 70 for the following types:
    - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262

## 2.6 UTP CABLES WET LOCATIONS OR SLAB ON GRADE

- A. Manufacturers: Subject to compliance with requirements, provide cable product by the specified UTP cable manufacturer article "UTP CABLE".
- B. Description: 100-ohm, 4-pair UTP, covered with a thermoplastic jacket.
  - 1. Match color in article "UTP CABLE".
  - 2. Comply with ICEA S-90-661 for mechanical properties.
  - 3. Comply with ANSI/TIA-568.2-D for performance specifications.
  - 4. Specifically designed for below-grade conduit or other environments where water is likely to infiltrate.
  - 5. UL Verified for long term water submersion.
  - 6. Comply with ANSI/TIA-568.2-D, Category 6A.
  - 7. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with NFPA 70 for the following types:
    - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262

## 2.7 UTP CABLE HARDWARE

- A. Manufacturers Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  - 1. Hubbell Premise Wiring
  - 2. Leviton Voice & Data Division
  - 3. SYSTIMAX Solutions; a CommScope, Inc. brand
  - 4. Uniprise, a CommScope, Inc. brand
  - 5. Panduit Corp.
  - 6. Simon Co. (The)
  - 7. Ortronics Corp.
  - 8. Belden, Inc.

## 9. Hellermann Tyton

- B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables
- D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. All patch panels shall be 48-port.
  - 1. Number of Jacks per Field: Provide one for each four-pair UTP cable indicated conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- E. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.
  - 1. Comply with ANSI/TIA-568.2-D, Category 6A.

### 2.8 UTP CABLE HARDWARE - WIRELESS ACCESS POINT

- A. Manufacturers: Subject to compliance with requirements, provide cable product by the specified UTP cable manufacturer article "UTP CABLE HARDWARE".
- B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. All patch panels shall be 48-port.
  - 1. Number of Jacks per Field: Provide one for each four-pair UTP cable indicated conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.
- D. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.
  - 1. Comply with ANSI/TIA-568.2-D, Category 6A.

### 2.9 PATCH CORDS

- A. Patch Cords: Factory-made, four-pair cables in 3'-20' in length; terminated with eight-position modular plug at each end. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure specified category performance. Patch cords shall have latch guards to protect against snagging.
  - 1. TR location: Provide one (1) patch cord to match cable and Jack Assembly category rating per port on the patch panel.

2. Floor outlet locations: Provide one (1) ten foot modular patch cord to match cable and Jack Assembly category rating per eight-position eight conductor modular receptacle.

#### 2.10 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.
  1. Comply with ANSI/TIA-568.2-D, Category 6A.
- B. Workstation Outlets: Provide connector assemblies mounted in single or multigang faceplates as shown on contract drawings.
- C. Provide faceplate types to match Division 26 section, "Wiring Devices."
  1. Plastic Faceplate: High-impact plastic, complying with color requirements in Division 26 Section "Wiring Devices"
  2. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices"
  3. Wall phone Metal Faceplate: Stainless steel, w/ Studs for Wall Mount Phone outlet.
  4. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords
  5. Legend: Factory labeled by silk-screening or engraving
  6. Legend: Machine printed, in the field, using adhesive-tape label
  7. Legend: Snap-in, clear-label covers and machine-printed paper inserts

#### 2.11 TELECOMMUNICATIONS OUTLET/CONNECTORS- WIRELESS ACCESS POINT

- A. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.
  1. Comply with ANSI/TIA-568.2-D, Category 6A.
- B. Workstation Outlets: Provide connector assemblies in two port surface mount box.
  1. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords
  2. Legend: Snap-in, clear-label covers and machine-printed paper inserts

#### 2.12 OUTSIDE PLANT CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the specified structured cabling solution manufacturer.
- B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568.2-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

- C. Connecting Blocks: 110-style IDC for Category 3. Provide blocks for the number of cables terminated on the block, plus 25% percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables

#### 2.13 COPPER CABLE PROTECTION UNITS

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
  - 1. Commscope
  - 2. Cira Telecom
  - 3. Tii Technologies Inc.
  - 4. Approved equal
- B. Provide all copper circuits with protection between each building with an entrance cable protector panel.
  - 1. All building-to-building circuits shall be routed through this protector.
  - 2. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the EF ground point.
  - 3. The installation shall employ three-element solid state protector modules.

#### 2.14 COPPER SPLICE CASE

- A. Copper splice cases as required for OSP splices and transition splice in TR/MC/EF sized to fit splice quantities. Manufactured by Preformed Line Products, 3M or approved equal.
- B. Copper splice will be performed in Maintenance Holes only.
- C. Splice case filling compound, re-enterable type: 3M 4442 or approved equal
- D. Heat Shrink Tubing: Highly Flame Resistant, semi rigid polyvinylidene fluoride (Kynar)

#### 2.15 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  - 1. Superior Essex Inc.
  - 2. CommScope, Inc.
  - 3. Corning Cable Systems
  - 4. General Cable Technologies Corporation

5. Belden, Inc.
6. Mohawk; a division of Belden CDT
7. Optical Cable Corporation
8. Uniprise; a CommScope, Inc. brand
9. SYSTIMAX Solutions; a CommScope Inc. brand
10. Hitachi Cable America Inc.

**B. Indoor OM4 Multimode**

1. Description: 50/125-micrometer, laser-optimized, 24-strand, nonconductive, tight buffer optical fiber cable
2. Comply with ICEA S-83-596 for mechanical properties.
3. Comply with ANSI/TIA-568.3-D for performance specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1651, and NFPA 70 for the following types:
  - a. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262
  - b. Riser Rated, Conductive: Type OFCR, complying with UL 1666
5. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.5 dB/km at 1300 nm
6. Minimum Modal Bandwidth: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm
7. Jacket:
  - a. Jacket Color: Aqua
  - b. Cable cordage jacket, fiber, unit, and group color shall comply with ANSI/TIA-598-B.
  - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
8. Conductive cable shall be steel **[or aluminum]** armored type.
9. Non- conductive cable shall be dielectric armored type.

**C. Indoor OS2 Singlemode**

1. Description: 24-strand fiber, nonconductive, tight buffer optical fiber cable
2. Comply with ICEA S-83-596 for mechanical properties.
3. Comply with ANSI/TIA-568.3-D for performance specifications.
4. Comply with ANSI/TIA-492-CAAA for detailed specifications.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1651, and NFPA 70 for the following types:
  - a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262
6. Maximum Attenuation: 0.3 dB/km at 1550 nm

7. Jacket:
  - a. Jacket Color: Yellow
  - b. Cable cordage jacket, fiber, unit, and group color shall comply with ANSI/TIA-598-B.
  - c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
8. Conductive cable shall be steel armored type.
9. Non- conductive cable shall be dielectric armored type.

## 2.16 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  1. Hubbell Premise Wiring.
  2. Leviton Voice & Data Division.
  3. Panduit Corp.
  4. Siemon Co. (The)
  5. Belden, Inc.
  6. Ortronics Corp.
  7. Corning Cable Systems
  8. Optical Cable Corporation (OCC)
  9. Hellermann Tyton
- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, simplex and duplex cable connectors
  1. Number of Connectors per Field: Provide one for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit the specified expansion criteria.
  2. Fiber optic enclosures shall be rack-mountable with accommodations for splice trays.
  3. Fiber optic enclosures shall be wall-mountable with accommodations for splice trays.
  4. Install fusion splice trays as needed for transition points and factory terminated pigtails.
  5. LC duplex 12-fiber coupler panels shall be used for multimode fiber.
  6. LC duplex 12-fiber coupler panels shall be used for singlemode fiber.
  7. Size fiber enclosure for 25% percent spare capacity.
- C. Patch Cords: Provide factory-made, dual-fiber cables in one (1) meter lengths. Supply LC duplex for one-half of the total termination points.

- D. Patch Cords: Provide factory-made, dual-fiber cables in three (3) meter lengths. Supply LC duplex for one-half of the total termination points.
- E. Cable Connecting Hardware:
  - 1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of ANSI/TIA-604-2, ANSI/TIA-604-3-A, and ANSI/TIA-604-12. Comply with ANSI/TIA-568.3-D.
  - 2. Multimode connector type: LC
  - 3. Singlemode connector type: LC
  - 4. Connectors for multimode and singlemode shall be field installed via fusion splicing.
- F. Wall mounted optical fiber slack loop holder
  - 1. Leviton 12" wire management ring48900-IFR
  - 2. Leviton 24" wire management ring48900-OFR
    - a. Place on wall to manage slack one for each fiber type

## 2.17 OPTICAL FIBER CABLE SPLICE

- A. Fiber splice shall be placed in a cabinet with tray quantities for total fusion splices for transition splice in TR. Manufactured by Corning or approved equal.

## 2.18 INNERDUCT

### A. OSP applications:

- 1. Description: Standard Outdoor Textile Innerduct, 3-inch, 3-cell, polyester and nylon resin polymer textile innerduct with factory-installed flat woven pull tape. Manufactured by MaxCell or approved equal.
- 2. Fittings:
  - a. Conduit Plugs: Use compression-type conduit plugs with locking nuts to seal and secure one or more textile innerducts within 4" conduits.
  - b. Termination Bags: Use inflation-type bags to seal and secure one or more textile innerducts within 2" or larger conduit.

### B. Indoor applications:

- 1. Description: Indoor, Riser-rated, 3-cell, nylon textile innerduct, Orange or White in color, with factory installed pull tape. Manufactured by MaxCell or approved equal.
- 2. Fittings:
  - a. Conduit Plugs: Use compression-type conduit plugs with locking nuts to seal and secure one or more textile innerducts within 4" conduits.
  - b. Termination Bags: Use inflation-type bags to seal and secure one or more textile innerducts within 2" or larger conduit.

### C. OSP applications:



1. Description: Corrugated High Density Polyethylene (HDPE) 1 ¼ inch Orange in color with factory installed pull tape. Manufactured by Carlon or approved equal.
2. Splices shall only be at Maintenance Hole locations if necessary. No splices shall be allowed in conduit.
3. Use PIC1 Nonmetallic internal coupling to join sections as needed.

D. Indoor applications:

1. Description: Plenum-gard 1 ¼ inch Orange or White in color with factory installed pull tape. Manufactured by Carlon or approved equal.
2. Splices shall only be in SEF or TR/MC/HC locations if necessary. No splices shall be allowed in conduit.
3. Use manufacturer approved nonmetallic internal coupling to join sections.
4. Use manufacturer approved nonmetallic internal coupling to join sections.

2.19 CABLE LUBRICANT

A. Cable pulling lubricant shall be utilized when pulling cable.

B. Product:

1. Ideal
2. Polywater
3. or approved equal

2.20 FIRE STOP CABLE PASS-THRU SLEEVES

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

1. Basis of design: Specified Technologies Inc.
2. Approved equal by:
  - a. 3M Corporation
  - b. Hilti CFS-MSL Modular Sleeve
  - c. Hilti Speed Sleeve
  - d. Wiremold- Legrand Corporation

B. Fire Rated Cable Pathways: STI EZ-PATH Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. The following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH Series 44 Fire Rated Pathway
2. Specified Technologies Inc. (STI) EZ-PATH Series 33 Fire Rated Pathway

- C. EZ-path series 44 wall sleeves shall be provided for all telecom room penetrations to cable distribution system.
- D. Horizontal cable pathway locations greater than 20 cables fire stop sleeves shall be STI EZ-Path series 33.
- E. Horizontal cable pathway locations fewer than 20 cables EMT sleeve with UL listed system for firestopping is acceptable. Caulks and sealants shall be as manufactured by STI, Hilti, 3M, Nelson, or approved equivalent.
- F. Fill ratio for fire stop EMT sleeves shall not exceed 20% fill capacity.

## 2.21 FIRE STOP CABLE MODULAR FLOOR GRID SYSTEM

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  - 1. Basis of design: Specified Technologies Inc.
  - 2. Approved equal by:
    - a. Hilti Corporation
    - b. 3M Corporation
- B. Fire stop sleeves located in the floor of TR's shall be STI EZ PATH Series 44 Modular Grid. Provide sleeves for all Telecom Room floor penetrations. Fill ratio shall not exceed 20% fill capacity.
  - 1. Product: EZDG444 single slot grid complete with EZ-PATH Series 44 modules
  - 2. Product: EZG844 with EZD444MB pathway modules.
  - 3. Product: EZG1644 with EZD444MB pathway modules

## 2.22 NON-RATED CABLE PASS-THRU SLEEVES

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  - 1. Basis of design: Specified Technologies Inc.
  - 2. Approved equal by:
    - a. 3M Corporation
    - b. Hilti Smoke and Acoustic Sleeve
    - c. Wiremold- Legrand Corporation
- B. Non-Rated Cable Pathways: STI EZ-PATH Brand device modules The smoke and acoustical pathway shall contain a built-in sealing system and shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall acoustical materials. The following products are acceptable:
  - 1. Specified Technologies Inc. (STI) EZ Path® Series 44 NEZ Smoke and Acoustical Pathway
  - 2. Specified Technologies Inc. (STI) EZ Path® Series 33 NEZ Smoke and Acoustical Pathway

3. SpecSeal® Smoke 'N' Sound Smoke and Acoustical Sealant
  - a. SNS120W 20 Oz Sausage - 36 cu in (592 ml)
  - b. SNS129W 730573111529 29 Oz Tube - 52 cu in (858 ml)
  - c. SNS105W 730573111543 5 Gallon Pail - 1,155 cu in (19.0 L) (White)
- C. Horizontal cable pathway locations fewer than 20 cables EMT sleeve with mineral or ceramic fiber stuffing insulation and smoke/acoustical Sealant.
- D. Fill ratio for fire stop EMT sleeves shall not exceed 20% fill capacity.

## 2.23 GROUNDING

- A. Comply with requirements in Division 27 Section "Grounding and Bonding" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-C.

## 2.24 LADDER RACK, SUPPORTS, AND ACCESSORIES

### A. Ladder Rack (Universal Cable Runway)

1. Ladder rack shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.
2. Ladder rack (side stringers) will be 9'-11 1/2" long. Cross members will be welded in between stringers on 12" centers beginning 5-3/4" from one end so that there are 10 cross members per ladder rack. There will be 10-1/2" of open space in between each cross member.
3. Ladder rack will be delivered individually boxed, and available in the multiple widths.
4. Finish shall be epoxy-polyester hybrid powder coat (paint) black in color.
5. Product: Chatsworths Products, Inc. (CPI), Universal Cable Runway: Part Number 10250-712, Universal Cable Runway, 12" Wide, Black or approved equal
6. Product: Chatsworths Products, Inc. (CPI), Universal Cable Runway: Part Number 10250-718, Universal Cable Runway, 18" Wide, Black or approved equal
7. Product: Chatsworths Products, Inc. (CPI), Universal Cable Runway: Part Number 10250-724, Universal Cable Runway, 24" Wide, Black placed in vertical positions or approved equal

### B. Ladder Rack Splices

1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
2. Grounding kits will provide a method of bonding ladder rack sections and turns together that is independent of the pathway splices. The grounding kit should be constructed of UL Listed components. The preferred solution is a #6 AWG green insulated stranded copper conductor connected on both ends to ladder rack using two-hole compression lugs and stainless steel hardware.
3. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.

4. Finish (of splice plates and hardware) shall be zinc plate in the color(s) specified below. Colors are applied as a chem. film over the zinc plate.
5. Product: Chatsworths Products, Inc. (CPI), Cable Runway Splices or approved equal

C. Ladder Rack Supports

1. Supports will be sized to match the width of the ladder rack that is supported. Some supports will work with all widths of ladder rack.
2. Each support will include a means of securing ladder rack to the support.
3. Supports will be manufactured from steel or aluminum.
4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below or zinc plate with a gold chem. finish specified gold. Included hardware shall be zinc plated with a gold chem. finish.
5. Product: Chatsworths Products, Inc. (CPI), Cable Runway Supports or approved equal

D. Ladder Rack Accessories

1. Cable straps used for attaching cable bundles to the ladder rack cross members must be reusable with a hook and loop-style closure, at least  $\frac{3}{4}$ " wide, and sized for cable bundles that are 2", 3" or 4" in diameter.
2. Cable retaining posts used to keep cable from falling off of the side of the ladder rack shall be manufactured from 1" by  $\frac{1}{2}$ " tubular steel with .065" wall thickness. Cable retaining posts will be 8" high and will attach to the side stringer of the ladder rack with included hardware. The top of the cable retaining posts will be fitted with a rubberized end cap to protect cables.
3. End caps used to cover the ends of ladder rack will be manufactured from a black fire-retardant rubberized material. End caps will be sized for  $\frac{3}{8}$ " wide by 1-1/2" high side stringers and will be sold in pairs.
4. End closing kits used to cover the end of ladder rack will be manufactured from  $\frac{3}{8}$ " wide by 1-1/2" high tubular steel with .065" wall thickness. Kits will consist of a bar cut to match the width of the ladder rack and the hardware required to attach the bar to the end of a length of ladder rack.
5. Radius drops used to create a radius to form cables over as the cables exit or enter the ladder rack will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3". Radius drops will attach to either the side stringer or the cross member of the ladder rack using a clevis pin. Radius drops will include 1-1/2" high cable spools that attach to the top of the radius drop to guide cables.
6. Movable cross members used to support cross member radius drops in between welded cross members on ladder rack will be manufactured from  $\frac{3}{8}$ " by 1-1/2" aluminum bar. Movable cross members will attach to ladder rack at the side stringers with included hardware so that the location of the movable cross member can be adjusted. Moveable cross member will support a cross member radius drop.
7. Cable spools used to separate ladder rack into multiple cable pathways will be made from a black flame retardant ABS. Cable spools will attach to the cross members with a clip that allows the width of the ladder rack to be divided into any proportion. The spools will be

3.94" tall, with a 1.94" diameter top, and a body that tapers from .88" (diameter) at the top to .62" (diameter) at the bottom.

8. Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack will be made from 1/8" x 1" steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack. The bracket will hang below the ladder rack a minimum of 4". The bracket support surface will be 4" long. The bracket will be zinc plated with a gold chem. finish.
9. Touch-up paint used on ladder rack and ladder rack system components will be color-matched to the finish on the ladder rack or component. A spray on and brush on option will be available.
10. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat (paint) black in color. Hardware will be zinc plated with a gold chem. finish.
11. Product: Chatsworths Products, Inc. (CPI), Cable Runway Accessories or approved equal

## 2.25 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches A-C Grade
  1. Provide materials that comply with performance requirements in AWPA C27. Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
  2. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5516, for plywood.
- B. All 4 walls shall be covered with rigidly fixed 3/4 inch A-C plywood with the A grade side facing outward. The plywood shall be void free and extend from 6 inches above the finished floor (AFF) to 102 inches AFF and capable of supporting the attached equipment.
- C. Comply with requirements in Division 09 Section "Paints and Coatings" for fire-retardant plywood.

## 2.26 EQUIPMENT FRAMES

- A. Free Standing Relay Racks
  1. Racks shall be manufactured from aluminum and/or steel extrusions.
  2. Each rack will have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack will assemble with bolt hardware. Equipment-mounting channels will be threaded for easy assembly. The base angles will be pre-punched for attachment to the floor.
  3. Equipment mounting channels will be 3" deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45 rack-mount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
  4. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19" EIA rack-mount equipment. Attachment points will be

threaded with 12-24 roll-formed threads. The rack will include assembly and equipment-mounting hardware. Each rack will include 50 each combination pan head, pilot point mounting screws.

5. The rack will be rated for 1,500 lb. of equipment.
6. The rack will be UL Listed.
7. Finish shall be epoxy-polyester hybrid powder coat black in color.
8. Product: Chatsworths Products, Inc. (CPI), Universal Self-Support Rack or approved equal

## 2.27 CABLE MANAGEMENT

### A. Vertical Cable Management for Racks

1. Every rack will have a minimum of one vertical cable manager. The vertical cable manager will create a space for storing and organizing cables along the side of the rack/frame. The cable manager will maintain separation between patch/equipment/jumper cords and premise cables. The last rack in a row shall have two vertical cable managers.
2. The cable manager will be sized to match cabling requirements and to fit the rack/frame or as specified. The initial quantity of cables within the cable manager will not exceed a whole number value equal to 40% of the interior area of the cable manager.
3. A single vertical cable manager can be used in between bayed racks/frames if it is sized to match cable requirements for both racks/frames. The manufacturer will state estimated cable fills for the cable manager in the product data sheet.
4. The vertical cable manager will match the height of the rack(s)/frame(s).
5. The vertical cable manager will bolt to the side of racks/frames with included hardware. The manufacturer of the vertical cable manager will sell compatible racks/frames.
6. The vertical cable manager will be a double-sided H-shaped trough with front and rear covers. The double-sided trough will provide independent front and rear cable pathways and will have multiple evenly-spaced edge-protected front-to-rear cable pass-through holes for cables in the center divider.
7. The front and rear covers will be removable, hinged to open from the right or left side and will include a latch that will secure the cover in the closed position.
8. The vertical cable manager will have cable openings along both sides of the trough. The openings will be formed by evenly-spaced T-shaped cable guides. The T-shaped cable guides will be made from a composite plastic material (not metal) and will have rounded edges to protect cables. When the cable manager is attached to a rack/frame, each cable opening will align with a rack-mount space (RMU) on the rack/frame. Each opening will pass a minimum of 24 each .25" OD patch cords.
9. The cable manager will be delivered individually boxed, and available in several widths as specified below and in the contract documents.
10. The vertical cable manager shall be manufactured from sheet aluminum and composite materials.

11. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. Edge-protectors, T-shaped cable guides and latch hardware is black.
12. Product: Chatsworths Products, Inc. (CPI): CCS MCS Master Cabling Section: Part Number Part Number 30095-703, MCS Master Cabling Section, Double-Sided, 6" Wide x 84" High x 16.15"D, Black or approved equal
13. Product: Chatsworths Products, Inc. (CPI): CCS MCS Master Cabling Section: Part Number Part Number 30096-703, MCS Master Cabling Section, Double-Sided, 10" Wide x 84" High x 16.15"D, Black or approved equal

B. Horizontal Cable Management for Racks, Frames or Cabinets

1. Place horizontal cable managers above and below each patch panel in each rack/cabinet. The horizontal cable manager will guide patch/equipment cords between the vertical cable manager and individual network port connections.
2. Provide 2 RMU of horizontal cable management above and below every patch panel. Cables must be able to access the cable manager so that no ports are blocked by the cables.
3. The manufacturer will state estimated cable fills for the cable manager in the product data sheet.
4. The horizontal cable manager will match the rack-mount width of the racks/cabinets.
5. The horizontal cable manager will attach to the front or rear of the rack/frame/cabinet with screws and will be sized to fit within standard EIA-310-D (1-3/4" high RMU) rack-mount spacing. The manufacturer of the horizontal cable manager will sell compatible racks/cabinets.
6. The horizontal cable manager will be a single-sided C-shaped trough with a cover. The single-sided trough will have a slot or holes at the rear to facilitate front-to-rear cabling through the horizontal manager. The front of the cable manager will have T-shaped cable guides along the top and bottom surfaces of the cable manager. Evenly spaced cable openings in between the T-shaped cable guides will allow cables to enter/exit the cable manager into the rack-mount space. The openings will have rounded edges to protect cables. The cover will be removable, hinged to open up or down and will snap on to secure the cover in the closed position.
7. The horizontal cable manager will be delivered individually boxed, and available in several widths and heights as specified below and in the contract documents.
8. The horizontal cable manager shall be manufactured from sheet aluminum and composite materials.
9. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. Edge-protectors, T-shaped cable guides and latch hardware is black.
10. Product: Chatsworths Products, Inc. (CPI), Universal Horizontal Cable Manager: Part Number 30130-719, Universal Horizontal Cable Manager, Single-Sided, 19" Wide x 2 RMU x 5" Deep, Black or approved equal

11. Product: Chatsworths Products, Inc. (CPI), Universal Horizontal Cable Manager: Part Number 30139-719, Universal Horizontal Cable Manager, Single-Sided, 19" Wide x 1 RMU x 5" Deep, Black or approved equal

## 2.28 POWER DISTRIBUTION UNIT (PDU)

### A. Vertical

1. Product Feature:
  - a. Monitoring Power - Local (Amps, Volts, Watts, Power Factor)
  - b. Digital RMS Scrolling Power Meter +/- 2% Accuracy with Full Scale 60Hz sine wave input.
  - c. Voltage 100-120V, Current 20A
  - d. On/off switch
  - e. Power Cable Length 10ft
  - f. Plug Type NEMA 5-20P
  - g. Receptacle Type NEMA 5-20R - twenty (20) each
  - h. Heavy Steel - Powder Coat Finish Black
  - i. Configuration - 66in Vertical Rack/Cabinet mount

## 2.29 UNINTERRUPTIBLE POWER SUPPLY

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  1. Chatsworths Products, Inc. (CPI)
  2. MinuteMan
  3. TrippLite
  4. American Power Company (APC)
  5. Cyber Power
  6. Approved equal
- B. Each equipment rack shall contain a rack mounted local uninterruptible power supply (UPS).
- C. The UPS shall be able to support its' associated rack enclosure in an active state of operation for not less than thirty-minutes.

## 2.30 IDENTIFICATION PRODUCTS

- A. Comply with ANSI/TIA-606-C and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Electrical Identification."

## PART 3 - EXECUTION

### 3.1 ENTRANCE FACILITIES



- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.
- B. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- C. Install pathways complying with recommendations in ANSI/TIA-569-E, "Entrance Facilities" Article.
  - 1. Install entrance pathway complying with Division 26 Section "Raceways and Boxes."

### 3.2 INSTALLATION OF PATHWAYS

- A. Comply with ANSI/TIA-569-E for pull-box sizing and length of conduit and number of bends between pull points.
  - 1. Pull boxes:
    - a. Provide pull boxes as required to ensure that no section of conduit exceeds 100' between accessible pull points.
    - b. No section of conduit shall have greater than two 90-degree bends or a cumulative 180 degrees of total bends.
    - c. Pull boxes shall be placed in straight sections of conduit and shall not be used in place of a bend.
    - d. Pull boxes should be readily accessible and shall be sized per the BICSI TDMM.
  - 2. Conduit bends:
    - a. The inside bend radius for conduit sized 2" or less shall be minimum six times the internal conduit diameter.
    - b. The inside bend radius for conduit larger than 2" shall be minimum ten times the internal conduit diameter.
- B. Comply with requirements in Division 26 Section "Raceways and Boxes" for installation of conduits and wireways.
- C. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- D. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches (76 mm) above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

### 3.3 NON-CONTINUOUS CABLE SUPPORTS

- A. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.
- B. Do not exceed load ratings specified by manufacturer.
- C. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.
- D. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.
- E. Bridle rings shall not be used for telecom cable support.

### 3.4 WIRING METHODS

- A. Wiring Method: Install cables in raceways, J hooks, and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables accessible ceilings, walls, and floors except in unfinished spaces.
- B. Install plenum cable in environmental air spaces, including plenum ceilings.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- D. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- E. Provide equipment frames and ladder racking as outlined in telecommunications series drawings.

### 3.5 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 6. Cables shall not be painted or exposed to any other building adhesives, paint, coatings, or other foreign agents.
  - 7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI ITSM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with ANSI/TIA-568.2-D.
2. Do not untwist UTP cables more than 1/4 inch from the point of termination to maintain cable geometry.
3. Terminate patch panels and outlets to a pin/pair assignment as directed by owner.

D. UTP Riser Cable Installation:

1. Comply with ANSI/TIA-568.2-D.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
3. Terminate patch panels to a pin/pair assignment as directed by owner.

E. UTP Patch Cords

1. Provide modular cords required to connect LAN switches to modular jacks on cross connect panel shall be furnished as part of this solicitation. Quantities should be equal to the total number of network outlets. At the Patch panel location provide patch cable lengths as needed for a neat installation utilizing vertical wire managers. At the user outlets provide 10 foot patch cables for each 8 pin modular connector

F. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. The telecom structured cable shall be supported by its own independent support system.

4. Plastic "zip-ties" shall not be used. Cables shall be bundled utilizing plenum rated hook and loop type cable ties.
- G. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
  2. Install cabling after the flooring system has been installed in raised floor areas.
  3. Coil cable 10 feet long not less than 12 inches in diameter below each feed point.
- H. Group connecting hardware for cables into separate logical fields.
- I. Optical Fiber Cable Installation:
1. Comply with ANSI/TIA-568.3-D.
  2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
  3. Fiber shall be installed in innerduct within conduits.
  4. Fiber shall be installed in innerduct within buildings.
  5. Multiple fibers shall be pulled in the same innerduct whenever possible.
  6. Fiber shall be installed in one continuous piece.
  7. Any excess fiber shall be coiled neatly and secured to a wall above the plywood backboard so it is out of the way of normal traffic and is not subject to unusual flexing.
- J. Outdoor Coaxial Cable Installation:
1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
  2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).
- K. Separation from EMI Sources:
1. Comply with BICSI TDMM and ANSI/TIA-569-E for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: minimum 5 inches
    - b. Electrical Equipment Rating between 2 and 5 kVA: minimum 12 inches
    - c. Electrical Equipment Rating More Than 5 kVA: minimum 24 inches
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: minimum 2-1/2 inches
    - b. Electrical Equipment Rating between 2 and 5 kVA: minimum 6 inches
    - c. Electrical Equipment Rating More Than 5 kVA: minimum 12 inches

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement
  - b. Electrical Equipment Rating between 2 and 5 kVA: minimum 3 inches
  - c. Electrical Equipment Rating More Than 5 kVA: minimum 6 inches
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: minimum 48 inches
6. Separation between Communications Cables and Fluorescent Fixtures: minimum 5 inches

### 3.6 INSTALLATION OF INNERDUCT

#### A. Textile innerduct shall be installed as follows:

1. In a clear 4-inch conduit, two (2) each 3" 3-cell with additional pull tape outside innerducts for future pulls.
2. Install per manufacturer's instructions.
3. Provide suitable slack in maintenance holes, hand holes, pull boxes, and at turns to ensure there is no kinking or binding of the product.
4. When exposed indoors or in maintenance holes, hold firmly in place using independent supports.

#### B. Standard Innerduct shall be installed as follows:

1. In a clear 4-inch conduit, provide three (3) each 1 1/4" innerduct.
2. In ducts with other cables, as many as possible without damaging the existing cables.

### 3.7 INSTALLATION TELECOMMUNICATIONS ROOMS

- A. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- B. Bond the shield of any shielded cable to the grounding busbar in communications rooms and spaces.
- C. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.
- D. Free Standing Relay Racks
  1. Assemble relay racks according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
  2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below. (Use CPI Part Number 40604-003 for concrete slab floors.)

3. Racks shall be grounded to the TGB using appropriate hardware. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
4. Ladder rack shall be attached to the top of the racks/cabinets to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.
5. The equipment load should be evenly distributed and uniform on the rack/cabinets. Place large and heavy equipment towards the bottom of the racks/cabinets. Secure all equipment to the racks/cabinets with equipment mounting screws.

E. Ladder Rack

1. Provide all components of the ladder rack system (ladder rack, turns, splices, supports, and accessories) from a single manufacturer.
2. Ladder rack shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.
3. Ladder rack shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).
4. Ladder rack splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.
5. Ladder rack shall be supported every 5' or less in accordance with TIA-569-E. Ladder rack shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support ladder rack within 2' on both sides of every change in elevation. Support ladder rack every 2' when attached vertically to a wall.
6. Heavy-duty splices are recommended for ladder rack in excess of 18" width (18" wide ladder rack). Heavy-duty splices are required for any splice formed in the vertical orientation including changes in elevation formed using vertical-to-horizontal 90° turns or horizontal-to-vertical 90° turns. Use heavy-duty splices to secure all overhead turns to the overhead horizontal pathway(s).
7. When the pathway is overhead, ladder rack shall be installed with a minimum clearance of 12" above the ladder rack. Leave a minimum of 12" in between ladder rack and ceiling/building truss structure. Leave a minimum of 3" in between ladder rack and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack shall be installed with a minimum clearance of 12" in between each tier of ladder rack. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the ladder rack.
8. When installed under a raised floor, ladder rack shall be installed with a minimum 3" clearance between the top of the ladder rack and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" clearance between ladder racks wherever ladder racks cross.
9. Within each telecommunications room, ladder rack should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack and turns shall be bonded across each splice with a

bonding kit. Ladder rack shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack where bonding/ground lugs contact the ladder rack so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack sections and turns and through the bond to the TGB.

10. The quantity of cables within the ladder rack will not exceed a whole number value equal to 50% of the interior area of the ladder rack divided by the cross-sectional area of the cable. The interior area of ladder rack will be considered to be the width of the ladder rack multiplied by a height of 2", unless cable retaining posts are added to the ladder rack. The interior area of ladder rack equipped with cable retaining posts will be considered to be the width of the ladder rack multiplied by a height of 6". Actual cable fill for ladder rack that is not equipped with cable retaining posts will not exceed 2" in height. Actual cable fill for ladder rack equipped with cable retaining posts will not exceed 6" in height.
11. The combined weight of cables within the ladder rack will not exceed the stated load capacity of the ladder rack as stated in the manufacturer's product specifications or load/design tables.
12. Cables (cable bundles) will be secured to the cross members of ladder rack with  $\frac{3}{4}$ " wide reusable straps. Straps are not required when ladder rack is equipped with cable retaining posts.
13. Add 8" high cable retaining posts to the open sides of ladder rack when cable fill exceeds 2" in height or when cable bundles cannot be secured directly to the ladder rack cross members with a strap. Cable fill within any ladder rack should not exceed 6" in height.
14. When a single ladder rack supports different types of cable media, the cable media will be separated within the pathway by cable spools that attach to the cross members on the ladder rack. Treat each type of cable media and divided area of the ladder rack separately when determining cable fill limits.
15. Use a radius drop to guide cables wherever cable exits overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field. If necessary, provide a moveable cross member also to attach and align the radius drop in between the welded cross members of a ladder rack.
16. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.
17. Use auxiliary support brackets that attach to the side stringer of the ladder rack to support interconnect cabling (patch cords, equipment cords, jumper cords) that is routed between racks using the ladder rack. Auxiliary support brackets can be used to support other conductors that should be physically separated from cables within the ladder rack as defined by local code or the authority having jurisdiction (AHJ).
18. Whenever possible, maintain a 2' separation between ladder rack used for communications cables and pathways for other utilities or building services.
19. Provide touch-up paint color-matched to the finish on the ladder rack and correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery. If a component is cosmetically damaged to the extent

that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.

#### F. Vertical Cable Managers

1. Attach vertical cable managers to the side of the rack/frame using the manufacturer's installation instructions and included hardware.
2. When a single vertical cable manager is used in between two racks, attach the vertical cable manager to both racks.
3. When more than one cable manager is used on a rack or group of racks, use the same make, style and size of vertical cable manager on the rack or in between racks.
4. The color of the racks and cable managers must match.
5. Doors should be attached to the cable manager and in the closed position after cabling is complete.

#### G. Horizontal Cable Managers

1. When more than one horizontal cable manager is used on a rack/cabinet or group of racks/cabinets, use the same make, and style of cable manager on the rack/cabinet or racks/cabinets.
2. The color of the racks and cable managers must match.
3. Attach horizontal cable managers to the rack/cabinet with four screws according to the manufacturer's installation instructions. Each cable manager should be centered within the allocated rack-mount space (RMU).
4. Horizontal managers will be located so that the number of ports (cables) they support will not exceed the cable fill capacity of the cable manager.
5. Covers should be attached to the cable manager and in the closed position after cabling is complete.

### 3.8 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
- C. Install EZ Path floor grid system for all Telecommunications Room floor penetrations with additional quantity as shown on contract drawings.
- D. Install EZ Path Series 44 modules for all Telecommunications Room wall penetrations with additional quantity as shown on contract drawings.
- E. Install EZ Path or EMT sleeve where horizontal cables penetrate a fire rated wall.



- F. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of firestopping products.
- G. Comply with ANSI/TIA-569-E, "Firestopping."
- H. Comply with BICSI TDMM, "Firestopping Systems" Article.
- I. Any penetrations created for the passage of telecommunications which remains vacant at the completion of the installation shall be fire-stopped.

### 3.9 NON-RATED CABLE PASS-THRU SLEEVES

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. General: Install through-penetration systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
- C. EZ Path® Series 44 NEZ Smoke and Acoustical Pathway per manufactures instructions
- D. EZ Path® Series 33NEZ Smoke and Acoustical Pathway per manufactures instructions
- E. Any EMT non-rated wall penetrations created for the passage of telecommunications shall have the annular space filled with mineral wool and Smoke and sound acoustical sealant.
- F. Any non-rated EMT wall penetrations created for the passage of telecommunications which remains vacant at the completion of the installation shall be filled with mineral or ceramic fiber stuffing insulation and smoke/sound acoustical sealant.

### 3.10 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with requirements in division 27 05 26 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- C. Comply with ANSI-J-STD-607-C.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.11 VIDEO SYSTEM INSTALLATION - BUILDING INTERIOR

- A. Install a completely functional, bi-directional RF Broadband video systems with self-terminating video outlets a built-in 75-Ohm resistor and a connector-actuated switch that automatically terminates the line when a cable connector is removed.
- B. Measure, confirm, adjust and test the available signal strength to +20 (in db value) in the main RF distribution amplifier or splitter output port located in the new MC Room.
- C. Adjust amplifier gain and make other system adjustments to achieve specified output levels (+3-6db range) at each outlet. Provide riser drawing with db loss calculations for approval prior to any RF video cable installation.

- D. Install Bi-directional Amplifier in the TR/MC and each TR/HC as needed to complete video system adjusting.
- E. Install Splitters and taps in each TR as needed to complete fully functional CATV distribution system as specified.
- F. The RG-6 station cable shall be supported every sixty (60) inches, and clearly indicate the jack and room number of the station end in indelible ink written on plastic cable tags attached to both ends of the cable.
- G. Connectors shall be chosen and installed so they can withstand thirty (30) pounds of pulling force without separating from the cable.
- H. Install Multichannel RF Fiber Optic AM Transmitter in the MC of the building location that is to be furnished by owner.
- I. Install Multichannel RF Fiber Optic AM Receiver in the MC of the project building.

### 3.12 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-C.
- B. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."
- C. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Cable Schedule: Post in prominent location in each equipment room and Telecommunications Room. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an AutoCad or Revit and PDF electronic copy of final comprehensive schedules for Project.
- E. Cable Schedule Spreadsheet: Provide sorted by each equipment room and Telecommunications Room. List incoming and outgoing cables and their designations, origins, and destinations. Furnish in Microsoft Excel final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for Telecommunications Rooms, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA-606-C. Furnish Autodesk Revit and PDF – project version -electronic record of all drawings.
- G. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

- a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
  - b. Label each unit and field within distribution racks and frames.
- 4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- H. Exposed Riser Cables in j-hooks, Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
- I. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-C.
  - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

### 3.13 SOURCE QUALITY CONTROL

- A. Factory test UTP and optical fiber cables on reels according to ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.
- B. Factory test UTP cables according to ANSI/TIA-568.2-D.
- C. Factory test multimode and singlemode optical fiber cables according to ANSI/TIA-526-14-A and ANSI/TIA-568.3-D.
- D. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

### 3.14 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Visually inspect UTP, multi-pair copper and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.
  - 2. Visually confirm cable category marking of outlets, cover plates, outlet/connectors, and patch panels.
  - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

- 271000-38  
03/29/2024

- b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

### 3.15 DEMONSTRATION

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

### 3.16 REPAIR/RESTORATION

- A. Protect adjacent surfaces. Repair damage to any surfaces occurring as a result of the work of this section. Repair of surfaces shall include re-painting in accordance with Division 09 section "Painting."

### 3.17 CLEANING

- A. At the completion of the system, restore aspects of the project site to its former condition. Remove daily waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this contract. Remove trash from all work areas. Do not use dumpsters or trash disposal without prior approval.

END OF SECTION 27 10 00

## SECTION 27 41 00 - AUDIOVISUAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. 11 52 13 – Projection Screens
- C. 27 05 28.48 – Multimedia Connection Wall Box
- D. 27 05 28.50 – Multimedia Flush Poke-Thru Device
- E. 27 41 13 – Multimedia Floorbox
- F. 27 05 26 – Grounding and Bonding for Communications Systems
- G. Audiovisual (AV) System Drawings
- H. Other Drawings
  - 1. Related Architectural Drawings; for reference only.
  - 2. Related Electrical Drawings; for reference only.

#### 1.2 REFERENCES

- A. Building Industry Consulting Services International (BiCSI), "Telecommunications Distributions Methods Manual," Fifteenth Edition.
- B. American National Standards Institute/Telecommunications Industry Association (ANSI/TIA) - 568.2-D, "Commercial Building Telecommunications Wiring Standard"
- C. ANSI/TIA-569-E, "Commercial Building Standard for Telecommunications Pathways and Spaces"
- D. EIA/TIA-606D, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"
- E. EIA/TIA-607-D, "Commercial Building Grounding/Bonding Requirements"
- F. National Electrical Code (NEC), 2020 - National Fire Protection Agency (NFPA) 70
- G. Institute of Electrical and Electronic Engineers (IEEE) 802.3 Carrier Sense Multiple Access with Collision Detection (Ethernet 10/100/1000/10000 BASE-T)
- H. Federal Communications Commission (FCC), Title 47, Code of Federal Regulations, Part 68.
- I. National Institution for Certification in Engineering Technologies (NICET)
- J. Audiovisual and Integrated Experience Association (AVIXA).

### 1.3 DEFINITIONS

- A. ADA: Americans with Disabilities Act
- B. ALS: Assistive Listening System
- C. AV: Audiovisual
- D. AVIXA: Audiovisual and Integrated Experience Association
- E. BICSI: Building Industry Consulting Service International
- F. Bid: Herein, used interchangeably with "proposal"
- G. CATV: Central or Master Antenna Television (broadband)
- H. DSP: Digital Signal Processor
- I. IR: Infrared
- J. NIC: material and work which is Not In Contract and for which the Installer is not responsible except as otherwise detailed herein.
- K. OFE: "Owner Furnished Equipment" which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.
- L. OFCI: "Owner Furnished Contractor Installed" Equipment which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.
- M. RCDD: Registered Communications Distribution Designer
- N. RF: Radio Frequency
- O. The term "shall" is mandatory.
- P. The term "will" is informative.
- Q. The term "should" is advisory.
- R. Term "provide" means furnish and install.
- S. AV Consultant: Convergent Technologies Design Group, Inc.
- T. Bidder: Qualified firm intending to tender a bid on the systems described herein.
- U. Construction Manager (CM) or General Contractor (GC): The representative responsible for general building construction and onsite coordination between sub-contractors

### 1.4 BID PROPOSALS

- A. Itemized Bid Response
  - 1. Each piece of equipment shall be individually priced and submitted with Bid Proposals. Provide itemized bid response to include equipment description, manufacturer, model

number, unit price, and quantity on a per room basis. All equipment prices shall reflect required modifications and accessories as needed for a complete and functioning system.

2. Non-equipment charges shall be outlined separately as a single line item on a per room basis. A sum of the audiovisual system total cost shall be provided with the bid proposal.
3. Be responsible for all equipment and installation as indicated in the construction documents. Any equipment omissions or modifications in the itemized bid response shall not serve as direction to omit or modify project scope without explicit written agreement from the owner, architect, and AV consultant.

**B. Contractor Qualification**

1. Demonstrate at least three (3) years' experience in fabrication, programming, assembly, and installation of audiovisual presentation and remote-control systems of similar magnitude and quality as specified for the subject job. Submit documentation to this effect with the bid response. Be an authorized sales and service center for all listed components and offerings in this specification.
  - a. The AV contractors own forces, at a minimum, are to perform the AV system Programming.
2. References: Furnish no less than three (3) references for installations of similar size (dollar amount & quantity of spaces receiving integrated technology) and scope, performed within the past three (3) years. At a minimum, reference information will include the reference company or institute name, contact person's name and title, telephone number, address, and detailed project description, project manager's name, and contact information of the organization that is responsible for day-to-day operation of the audiovisual installation.
3. Programming shall be completed by contractors' own staff.

**C. Alternate Proposals**

1. Any proposed alternate equipment choices should be requested in writing prior to the proposal submission for approval. Each item on the alternate equipment list must be accompanied by catalog cut sheets and technical specifications.

**D. Non-Equipment Charges, including but not limited to:**

1. Engineering: Including all required design drawings, run sheets, instruction manuals, console layout, step-by-step user guide, etc.
2. Pre-Installation: Work performed on the Installer's premises including all fabrication, modification, assembly, rack wiring, etc.
3. Installation: Including all on-site installation and wiring, shop drawing, coordination and supervision, testing, checkout, Owner training, etc., performed on the Owner's premises.
4. General and Administrative: Including all shipping, insurance, and guarantees.

**E. Owner Furnished Equipment (OFE, OFCI)**

1. Identify any Owner Furnished Equipment assumed in the Bid Proposal to be installed and integrated under this contract. Identify all assumed Owner Furnished equipment within each room/space type that will be required to complete the AV systems installation.



#### F. State of the Art Development

1. Supply only the manufacturer's latest developed product. In cases where product development surpasses the criteria of the specification, inform the Architect and make the newer product available to the project at no additional cost. In no case shall discontinued or obsolete equipment be acceptable. The same requirement applies to software programs developed/updated during the warranty period.
2. Should a manufacturer discontinue a specified product, provide the manufacturer's recommended replacement at no additional cost to the owner. Should the manufacturer have no direct replacement product, Propose a product of equal or greater specification from an alternate manufacturer at no additional cost to the owner.
3. Should a product recall by a specified manufacturer require temporary or permanent replacement of a product specified under this section, notify the Architect at the earliest possible time and arrange to replace the product in question as quickly as possible.
  - a. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
  - b. Equipment defect or intended recall shall not relieve the AV Contractor from any contractual obligations with regard to delivery schedule of product.
  - c. Under no circumstances shall arrangement for alternate product require the Owner to accept superseded equipment except on a temporary basis.

#### G. Service Contract

1. Submit the costs for a one-year service contract, renewable for up to three years, which shall commence with the completion of the two-year warranty period. These contracts shall be fixed-cost and can be accepted at the option of the Owner.
2. The service contract shall include all services provided during the warranty period, including complete replacement or repair of defective equipment.

### 1.5 QUALITY ASSURANCE

#### A. Coordination

1. Coordinate this Section with work of other Project Manual sections and associated trades.
2. Specific references, herein, requiring coordination of certain work shall not obviate responsibility for other required coordination.

#### B. Standards and Codes

1. Comply with
  - a. Local, state and federal codes
  - b. Applicable National Electrical Code
  - c. American National Standards Institute
  - d. Underwriters' Laboratories, Inc. standards.
2. All equipment, material, accessories, and loose items provided shall be new and shall conform to applicable requirements of the above-mentioned agencies.
3. If required by local authorities, provide certificates and labels indicating compliance with above-mentioned codes and standards where applicable.

### C. Point of Contact

1. Designate to the Owner in writing, the responsible person who shall ensure timely and consistent communication with the Owner on progress of the contract. The designated representative shall have full knowledge of all engineering and production procedures and shall report status of the installation and upcoming work plans to the Owner's Project Manager and Consultant on a weekly basis.
2. Project manager shall have successfully managed not less than two (2) projects of similar size and scope (as defined in previous sections). Bid submission shall detail the percentage of time that the project manager and other key personnel will be involved with the project.

## 1.6 SCOPE OF WORK

### A. Provide the following in accordance with Specifications and Drawings:

1. Submittals delivered in a timely manner as described hereinafter.
2. Verification of dimensions and other conditions at project site. Review Conduit System as shown in building Construction Documents and, where applicable, as-built conditions. Notify Consultant, Architect, GC, and EC within four weeks after award of contract of any deficiencies or inadequacies in conduit/infrastructure system design. Review Telecommunications Structured Cabling System to ensure sufficient network connections are provided to support the Audiovisual Systems.
3. Review all AV equipment mounting and rack enclosures to verify dimensions, power provisions, and ventilation. Notify Consultant, Architect, GC, and EC within four weeks after award of contract of any deficiencies or inadequacies in equipment rack enclosures and mounting locations.
4. Detailed design of Digital Signal Processor system "maps," including remote-control accommodations.
5. Complete programming of audiovisual remote-control system inclusive of graphical layout and source code programming
  - a. Programming shall be completed by contractors' own staff.
6. Power distribution within equipment racks including power connection to electrical outlets as described in the electrical sections of the building construction documents.
7. Incidentals necessary for a complete working system.
8. Initial testing and adjustments, demonstration of system for approval, participation in acceptance tests, final adjustments as required.
9. Record Documents, "As-Built" drawings and Owner's Manual.
10. Training of operating personnel.
11. Notify appropriate parties of conflicts in a timely manner.
12. Work cooperatively with other trades to resolve conflicts.

### B. Special Insurance

1. Provide insurance fully covering all equipment against loss and damage during shipment, storage, installation, testing, adjustment and demonstration.

## 1.7 SYSTEM DESCRIPTION

### A. Design Intent

1. Provide a complete and functioning audiovisual (AV) system inclusive of all hardware, software and training to meet or exceed the performance features outlined in this document.

### B. Design Standards

1. The Owner's goal is to have available a cohesive and fully functional system. Therefore, part of the development efforts for successfully implementing the AV systems should include:
  - a. Install the system in a manner that complies with BiCSi and AVIXA cable routing standards. Route all audio, video, and control cabling elements in a subtle, unobtrusive manner to maintain the architectural and visual integrity of the building.
  - b. Except where plenum cable is used above finished ceilings, it is required that all cabling be routed inside the comprehensive system of conduit. Floor and wall boxes shall serve as the primary interface points to the AV system.
  - c. Provide and install cover plates, connectors, and associated cabling to link all floor and wall boxes to all affiliated local and remote AV components. No wiremold or surface-mounted raceway will be permitted unless explicitly specified. Coordinate faceplate materials, colors, and finishes with the faceplates used by other trades on the project and the architect to match aesthetics.
  - d. Provide and install security covers on any electronics with front panel controls that should not need to be adjusted after initial set-up. All components permanently mounted to rack rail systems shall be installed with industry accepted security screws.
  - e. All ceiling mounted AV equipment shall be secured to building structure.
  - f. No more than thirty lamp hours shall be expired for projection system set-up at the time of final systems acceptance. Should more hours than this be expired, replace the lamp at no cost to the Owner.
  - g. Steel cable security systems and padlocks to secure structure shall be provided for all surface-mounted loudspeakers, document cameras, video cameras, flat panel displays, and projectors. All padlocks provided for security shall be keyed to a single master key.
  - h. Provide an intellectual property release and install an editable version of all master source code for all digital signal processing, remote control or microprocessor-based systems included on this project to an owner furnished personal computer. Also provide a hardcopy on portable media.
  - i. Provide necessary audio, video, RGBHV, HDMI, DVI, USB, and control signal repeaters, extenders, and amplifiers for any run greater than 30 feet and as needed to maintain required signal levels for receipt at destination device. All audio lines shall be balanced at the source, prior to any cable pull longer than 20 feet. There are no exceptions.
  - j. Video camera locations shall receive AC power from associated equipment rack low voltage transformers within 60 feet.
  - k. For each input/output point of interface to the system, provide a suitable length patch cord for owner use for every signal type present. Provide umbilical style cable management for any mobile solutions.
2. Performance Standards: Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise required, the following minimum performance standards shall be met by each system:

- a. Analog Audio:
  - 1) S/N (including crosstalk and hum):75 dB minimum
  - 2) Total Harmonic Distortion:0.5% maximum from 30 Hz to 15,00Hz.
  - 3) Frequency Response: Flat within +1.0 dB, 30 Hz to 15,000Hz.
- b. Analog Video:
  - 1) S/N (peak to RMS) unweighted DC to 4.2 MHz: 45-dB minimum
  - 2) Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum
  - 3) Frequency Response(composite):Within +0.5 dB to 10 MHz
  - 4) Frequency Response(component):Within +0.5 dB to 100 MHz
  - 5) Line and Field Tilt:2% maximum
  - 6) Differential Gain:3% maximum
  - 7) Differential Phase:2 degrees maximum
- c. Digital Visual Interface (DVI):
  - 1) TMDS Channel Pixel Clock Support up to 165 MHz
  - 2) EDID Support DDC
- d. High Definition Multimedia Interface (HDMI):
  - 1) TMDS Channel Pixel Clock Support up to 340 MHz
  - 2) Bandwidth for 1080p signals Support Deep Color and 3D
  - 3) Bandwidth for 4k signals Support HDR, 60fps, 4:4:4
  - 4) EDID and CEC Supported
- e. AV Over IP
  - 1) H.264 Support up to 1080p/60
  - 2) H.265 Support up to 4K/60, 4:2:2
  - 3) M.JPEG Support up to 4K/60, 4:4:4
  - 4) Other proprietary codecs Support minimum 1080p/60
  - 5) The latency for all in-room sources visible within a given space shall not exceed 30ms.
- f. Network Audio:
  - 1) Dante minimum 48kHz, 24-bit, 64i/64o
  - 2) AVB minimum 48kHz, 24-bit, 64i/64o
- g. Performance Test Signal Paths: The signal paths for the above Performance Standards shall be as follows:
  - 1) Audio: From any and all source inputs (for microphones, computers, wireless presentation gateways, etc.) through all audio processing, preamplifiers, audio distribution amplifiers (ADA), mixers, switchers, codecs, encoders, decoders, etc., to all electrical signal destinations.
  - 2) Video: From all source inputs (for cameras, computers, wireless presentation gateways, etc.) through all distribution amplifiers (VDA), processors, switchers, matrices, encoders, decoders, transmitters, scalers, etc., to all signal destinations.
- h. Remote-Control Standards: As a minimum, the remote-control system for each space shall be programmed to include the following:
  - 1) Owner Logo on first page.
  - 2) Automatic System Shutdown.
  - 3) AM/PM Clock Settings.
  - 4) 50% or other reasonable audio level default.
  - 5) Separate Program and Microphone Audio Level Control with mute function.
  - 6) Volume/Mute controls for program and speech audio reinforcement on every screen.
  - 7) Panel layout to include user screens with separate, password protected technician pages.
  - 8) Raise and lower the projection screen when projection is powered off/on, respectively.
  - 9) Assign the room computer as default system source upon power up.

- 10) Activate a minimum of three (3) presets for each installed remote-controllable video camera.
- 11) Provide remote-control room management software and full licensing for each system on the project.
- 12) Full function control of all source components, display units, processing devices and switching electronics.
- 13) In sub-dividable spaces, provide both IR and closed contact partition sensor control, and automation of control system scenarios. Provide an additional option for manual override within a password-protected technician page.
- 14) Touch panel page layouts shall be submitted for approval. Prior to designing touch panel layouts, meet with the Owner to review existing control system standards on campus and determine a basis of design.
- 15) Follow-up programming and modifications as requested by the Owner shall be provided 6 months after system acceptance. Provide and install updated editable source code to the Owner following these updates.
- 16) In the event the remote-control system programming becomes compromised during the warranty period, provide the necessary effort to make the system fully functional once again.

#### C. Category Rated Cabling

1. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
2. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

### 1.8 SUBMITTALS

#### A. Related Sections

1. Comply with requirements of Section 01 33 00, "Submittal Procedures."

#### B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
  - a. Cover Sheet
    - 1) Include name of supplying contractor and project name.
    - 2) Include submittal and revision number.
  - b. Detailed Bill of Materials
    - 1) Include a listing of: component quantities, equipment manufacturers, model numbers, descriptions of each component being supplied, and the specification paragraphs or drawing sheets that correspond to each product.
    - 2) The bill of materials shall be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
    - 3) Failure to provide this information will result in the rejection of submittals.
  - c. Product Data

- 1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
- 2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
- 3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight. All optional components and selections shall be clearly indicated.
- d. Authorized Distributor Certificate
  - 1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.
- e. Prequalification Warrantee - Category Rated Cabling
  - 1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is Authorized to obtain for the owner the Special Warranty for Cabling System and the Special Warranty for System Assurance.
- f. Submittal shall be a single PDF file.
  - 1) Partial submittals, or submittals comprised of multiple PDF files, will be rejected.

#### C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
  - a. Title Sheet with sheet index and symbols legend
    - 1) Include a list of all drawings in the set and a symbols legend defining each symbol used in the package.
  - b. All panels, plates, and designation strips, including connectivity, layout, labeling, and details relating to terminology, engraving, finish and color
  - c. All equipment racks, cabinets, consoles, tables, carts, support bases, and shelves
  - d. Schematic drawings (AV & Control Signal Flows), system functional block drawings, including those for audio and video subsystems
  - e. All unusual equipment modifications
  - f. Equipment rack elevations
  - g. Equipment location drawings
  - h. Dimensions for all AV equipment racks and enclosures, verifying adequate space, power, and ventilation are provided
  - i. Cable labeling plan
  - j. Floor Plans, RCPs and Elevations:
    - 1) Show planned location for all elements and cable routing.
    - 2) Indicate projector distance, throw ratio, and lens.
    - 3) For any inductive loop assisted listening systems, indicate the inductive loop pathway.
2. Drawings should be at project standard scale and clearly legible.
3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

#### D. Form

1. Submit all materials for review as described above, specifically referenced to the specification paragraph number (where applicable).
  - a. Submit all drawings on sheets of one size, preferably the project standard size.
  - b. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.
2. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following submittals shall not be considered partial:
  - a. Personnel
  - b. Milestones
  - c. Conduit Verification Statement and Notifications
  - d. Rigging and Mounting Drawings
  - e. As-Built Documentation
3. Product Data and shop drawings must be submitted together in order to be reviewed.

#### E. User Interface

1. In order to develop a user interface which is both functional and useable, provide working "Beta" copies of system software for review and comment by the owner, architect and the AV consultant as per the below listed schedule:
  - a. This is anticipated to be an interactive process, requiring at least three submittals prior to first beneficial use. At a minimum, the software development process will have the following milestones:
    - 1) Initial concept submittal for review
    - 2) First Beta Review
    - 3) Second Beta Review
    - 4) Final implementation and onsite training: Prior to final acceptance
    - 5) Follow-up programming review and updates: within sixty-days from final acceptance

#### F. Weekly Reporting

1. Commencing with project award, provide weekly status reporting of milestone task status, anticipated completion date, and related memo notes for the following tasks:
  - a. Submittals
  - b. Infrastructure verification
  - c. Pre-wire status
  - d. Equipment Procurement
  - e. Shop fabrication
  - f. Remote control system design
  - g. Installation and Terminations
  - h. Field testing and pre-acceptance testing
  - i. Final acceptance demonstrations
  - j. Owner training
  - k. First owner use
  - l. Open Coordination Items and Questions
2. See below for a partial example of an acceptable weekly reporting list.
  - a.

Project: Project Name				
Location: Project Location			Date: Form Delivery Date	
Project Manager: Project Manager			Delivered by: Form Delivered By	
		Projected Completion:	Status:	Notes:
Infrastructure Verification:		6/1/2018	Complete	
Submittals:				
	Product Data	8/1/2018	Complete	
	Drawings	8/1/2018	Complete	
	Personnel (etc.)	8/1/2018	Complete	
RFIs:				
	12	8/25/2018	Received	Implementing
	178	9/6/2018	Pending	Projector Screen Clearances
Installation Status by Space				
Room		Equipment		
Name	Number	Pre-Wire	Order	Receive
Example 1	105	100%	100%	100%
Example 2	135	100%	100%	100%

b.

#### G. Personnel

1. Provide, in writing, within two weeks after award of Contract, the names, mailing address, phone numbers with extensions, email addresses and paging service numbers (if available) of the following project personnel:
  - a. Project Manager
  - b. Lead Systems Engineer
  - c. Field Foreman
  - d. Remote Control System Programmer

#### H. Conduit Verification

1. Within four weeks after award of Contract, submit statement confirming that the conduit system as designed in building construction documents has reviewed and, where applicable, as built.
2. Notify Consultant, General Contractor, Architect or Electrical Contractor of deficiencies or inadequacies, if any, in conduit system design or installation. If none, so indicate.
3. Absent conduit verification and after installation of conduit as designed, assume costs of equipment, materials, labor and engineering, including services of owner's representative(s) in designing and/or verifying revised wiring approach(es) as relate to providing a fully functional system using conduit as designed or as revised at the discretion of the owner.

#### I. Color Selection

1. Indicate color options for all items as applicable.



2. Coordinate wallplate finishes with the Architect.

J. Samples

1. Provide color and finish samples of any furniture or lecterns.

1.9 CLOSEOUT SUBMITTALS

- A. At the completion of the installation, but before Final Acceptance, provide for review and approval the following, in compliance with Division 1 Section *Closeout Procedures*.
1. Operation and Maintenance Manuals:
    - a. Equipment manufacturer's operation and service manuals for each make and model of equipment.
    - b. System Operation Manual. Produce a manual specifically for the subsystems detailed herein. The manual shall describe all procedures necessary to activate each system and provide the functional requirements, except as specifically excluded by the Owner. This section shall provide a simple "How-to" user's guide for the procedures needed to operate the system. This document shall contain a section on operating the systems equipment in the event of control system failure. Control system touch panel layouts shall be accompanied by narrative text describing "step-by-step" function engagement.
  2. Warranty
    - a. Provide list and dates of activation of equipment warranties.
    - b. Provide original manufacturers' certificates.
  3. As-built Drawings
    - a. Include contractor-generated digital record diagrams for all systems including, but not limited to:
      - 1) Schematic wiring diagrams with cable markings
      - 2) Internal wiring diagrams of the equipment rack cabinets
      - 3) Custom equipment modifications
      - 4) Final test results and nominal settings for all adjustable controls
    - b. Resubmittal or markup of contract documents will not be accepted.
  4. AV Passwords and Security
    - a. Software Passwords Schedule (i.e., a spreadsheet listing the manufacturer, model number and location in the Facility, of each piece of audio/video equipment, the software for which is password-protected)
    - b. Provide to Owner's Representative as a secure document, separate from Operations and Maintenance Manuals and As-Built Drawings.
    - c. IP address schedule for all network-addressable AV devices
  5. Editable Control System Code
    - a. Provide the final control system code in an editable format.
  6. Laminated Instruction Cards
    - a. Provide 8 ½ x 11 Instruction cards, approved by the Owner. Laminate step-by-step instructions outlining system operations for each room that has an AV system. Provide editable file of card to Owner.

1.10 IDENTIFICATION CATEGORY RATED CABLING

- A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-C. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."

- B. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA-606-C. Furnish AutoCad - latest version -electronic record of all drawings.

#### 1.11 DELIVERY, STORAGE, HANDLING, AND STAGING

- A. Supply, transport, deliver, unload, move to the installation location, unpack, place, assemble, secure, connect, and install all equipment needed to complete the installation. Be responsible for transportation, parking, delivery, and on-site storage of the system's equipment. Be responsible for all transportation of personnel to and from the site.
- B. Reconfirm before delivery that hallways, stairways, passages, doorways, rooms, entries, elevators and foyers are of sufficient size to accommodate the passage and installation of the equipment and systems. Offsite pre-staging of goods is encouraged.
- C. The Owner's acknowledgment of delivery of goods and any payment made on account of such delivery shall not constitute acceptance (partial or otherwise) and shall not diminish obligations as specified.
- D. The actual dates of delivery shall be under the absolute control of the Owner. The dates and times for delivery/installation are critical to the successful completion of the project. Deliveries shall normally be accepted only Monday through Friday 8:00 a.m. to 4:00 p.m. In the event it becomes necessary for goods to be installed outside these hours comply with the instructions of the Owner. Deliveries attempted outside these hours without prior consent of the Owner may be turned away. Comply with all instructions of the Owner and the Contractor concerning time of arrival at the site; which entrance shall be utilized for delivery; routes to be taken to reach the installation location; and other matters relating to the orderly and timely installation of the system.
- E. Installation shall commence immediately upon delivery of materials to the jobsite, except as directed by Construction Manager. Time required from delivery date to completion of project shall be in accordance with the approved schedules.

#### 1.12 SYSTEM TRAINING

- A. Training: Provide training in the operation and maintenance of the system for personnel designated by the Owner. Record owner training sessions on DVD or other agreed upon media, and make training videos available to the owner at no charge. The training shall be organized as follows:
  - 1. Two (2) two-hour training classes for system technical operation and maintenance. This class shall cover the following topics:
    - a. Review of signal flow diagrams
    - b. Review of all equipment functions, relevant to the function in this system
    - c. Review of initial equipment settings
    - d. Demonstration of all functional connections from a user perspective
    - e. Review & demonstration of replacement procedures for consumables (e.g., lamps)
    - f. Review of manufacturers' recommended routine maintenance procedures
  - 2. Two (2) two-hour training classes for system engineering concerns. This class shall cover the following topics:
    - a. Review of signal flow diagrams

- b. Review of all equipment functions, relevant to the installation
  - c. Review of initial equipment settings
  - d. Review of manufacturer's recommended routine maintenance procedures
  - e. Review & demonstration of replacement procedures for consumables (e.g., lamps)
  - f. Review & demonstration of control system software replacement/upgrade procedures
3. Two (2) four-hour training classes addressing AV system operations. The classes will demonstrate and describe the following:
    - a. System set-up and operations
    - b. Control system operation
    - c. How to attach microphones, record AV signals, and control the sound system
    - d. Videoconferencing operation & capabilities (if applicable)
    - e. Audio monitoring and ADA system operations
    - f. Cable antenna television system (CATV)
  4. Training may take place at any time (chosen by the Owner) after the systems are operational, up to a year following system acceptance.
  5. Closeout submittals shall be provided prior to any training classes.
  6. Coordinate detailed specifics of the training session(s) time, date, and location with the Owner.

#### 1.13 WARRANTY

- A. The system warranty shall be for twenty-four (24) months from the date of final acceptance. Provide all equipment, material, and labor required to uphold a full system warranty at no charge to the Owner. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of final acceptance. In the case of modified equipment, the manufacturer's warranty is normally voided. In such cases, provide the Owner with a warranty equivalent to that of the original manufacturer.
- B. There shall be no cost to the Owner for maintenance performed during the warranty period beyond the fixed cost of the contract.
- C. Coordinate and provide updates to the control system code & touch panel layouts based on owner feedback of desired functionality during warranty period.
- D. Provide a total of eight (8) one-day visits per year, or a total of sixty-four (64) engineering/ service labor hours to conduct preventive maintenance and the Owner directed system adjustments.
- E. Each visit will include:
  1. Cleaning optical lenses
  2. Checking and replacing projection lamps filters and indicators
  3. Checking and repairing microphones and microphone cables
  4. Conducting subjective and objective tests of the audio, video, and control systems of the installed audiovisual systems

- F. Repair and adjust any malfunctioning components located by the technician during this testing. Include control system programming updates and modifications as part of this service contract, providing an updated editable copy of the source code to the Owner.
- G. Provide a service telephone number, staffed by a qualified technician familiar with the equipment installed. Staff this number during normal business hours.
- H. Respond with an on-site technician within 24-hours of a service call (including Saturdays and Sundays) for all equipment and system failures.
- I. Replace or repair, at no cost to the owner, any failed equipment hardware or software installations required to provide full system operations.
- J. During the warranty period, advise the Owner in writing each time any routine software and firmware updates become available, giving the Owner the opportunity to upgrade the software/hardware should they so desire at no additional cost. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.
- K. Provide updates to firmware during service period. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.

#### 1.14 WARRANTY CATEGORY RATED CABLING

- A. Special Warranty for Cabling System: Manufactures warranty shall ensure against product defects; that approved cabling components exceed the specifications of ANSI/TIA-568.2-D, ANSI/TIA-568.3-D, and ISO/IEC IS 11801; exceed the attenuation and NEXT requirements of ANSI/TIA-TSB-67 and ISO/IEC IS 11801 for cabling links/channels; and that the installation will exceed the loss and bandwidth requirements of ANSI/TIA-TSB-67 and ISO/IEC IS 11801 for fiber links/channels. The warranty shall apply to passive SCS components.
  - 1. Warranty Period: 25 - year Cabling System from date of Substantial Completion
- B. Special Warranty for System Assurance: Manufactures warranty shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that recognize ANSI/TIA-568.2-D, ANSI/TIA-568.3-D, or ISO/IEC IS 11801 component and link/channel specifications for cabling.
  - 1. Warranty Period: 25 - year Applications Assurance from date of Substantial Completion

## PART 2 - PRODUCTS

### 2.1 PATHWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, and are limited to, the following:
  - 1. Basis of design: ERICO
  - 2. Approved equals by:
    - a. Eaton/B-line
    - b. Hilti Inc.
- B. General Requirements: Comply with ANSI/TIA-569-E.

- C. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable.
- D. Provide bend limiters, if not built into the cable support, to maintain cable type bend radius whenever cable exists pathways or makes transition between two pathways.
- E. Bridle rings shall not be used for cable support.
- F. Non-continuous cable supports
  - 1. Cable Support shall be NRTL labeled for support of Category Rated cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 2. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.
  - 3. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
  - 4. Non-continuous cable supports sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.
  - 5. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.
  - 6. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.
  - 7. Support accessories:
    - a. Fastener to C or Z purlin
    - b. Fastener to threaded rod
    - c. Fastener to wire
    - d. Beam clamps
  - 8. Non-continuous cable supports shall be ERICO CableCat™ J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CMTM Double J-Hook CAT100CM; CAT-CMTM U-hook series CAT200CMLN, CAT300CMLN; and CAT-CMTM retainer CATRT200CM, CATRT300CM, or approved equal.

## 2.2 POWER DISTRIBUTION UNITS (PDU)

- A. Each AV equipment cabinet is to contain a rack mounted power distribution panel (PDU).
  - 1. Horizontal: For rack/cabinet less than 42U. PDU to occupy the first rack space in each rack/cabinet.
    - a. Product Feature:
      - 1) Two (2) pull out LED lights
      - 2) Digital voltmeter/ammeter, with discrete dimmer button, displays line voltage and RMS current draw
      - 3) Isolated outlet banks minimize inter-component interference and noise contamination
      - 4) 20A rating with a high inrush magnetic circuit breaker
      - 5) Minimum of Nine (9) outlets (eight (8) rear panel outlets and one (1) front panel convenience outlet)

- 6) Plug type NEMA 5-20P, Receptacle Type NEMA 5-20R
  - 7) Heavy Steel - Powder Coat Finish Black
2. Vertical: For rack/cabinet equal to or greater than 42U.
  - a. Product Feature:
    - 1) Monitoring Power - Local (Amps, Volts, Watts, Power Factor)
    - 2) Digital RMS Scrolling Power Meter +/- 2% Accuracy with Full Scale 60Hz sine wave input
    - 3) Voltage 100-120V, Current 20A
    - 4) On/off switch
    - 5) Power Cable Length 10ft
    - 6) Plug Type NEMA 5-20P
    - 7) Receptacle Type NEMA 5-20R - twenty (20) each
    - 8) Heavy Steel - Powder Coat Finish Black
    - 9) Configuration - 66in Vertical Rack/Cabinet mount

## 2.3 IDENTIFICATION PRODUCTS

- A. Comply with ANSI/TIA-606-C and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Electrical Identification."

## 2.4 AV NETWORK SWITCHES

- A. Ensure compatibility with the following standards, where applicable:
  1. AVB
  2. Dante
- B. Provide a gigabit, managed switch with the following features:
  1. Minimum gigabit ports for inter-switch connections
  2. Quality of Service (QoS) with four (4) queues
  3. Diffserv (DSCP) QoS, with strict priority
  4. If the switch includes Energy Efficient Ethernet (EEE), verify this feature can be disabled. Disable EEE for all ports.
  5. IGMP Snooping (with option to enable/disable)
  6. Two (2) SFP ports.
- C. The switch shall have an internal power supply with an IEC connector. External switching power supplies are not acceptable.
- D. Provide a switch with an integrated browser-based user interface.

## 2.5 AV EQUIPMENT

- A. HD Television Tuner

1. XM Ready
  2. Triple IR Code Sets
  3. 200 Station Preset Memory
  4. Dual Analog Audio Outputs
  5. Provide optional rack kit (2RU)
  6. Product: Contemporary Research 232-ATSC or approved comparable product.
- B. Wireless Presentation Gateway
1. Accommodates multiple simultaneous users.
  2. Customizable display layouts
  3. Controlled over IP network.
  4. HDMI output up to 1080p
  5. Product: Crestron AM-3200 or approved equal
- C. 10" Control Touch Panel
1. TFT Active Matrix color LCD display
  2. 15:9 aspect ratio
  3. Edge lit LED.
  4. Core 3 UI Graphics
  5. Provide table mount kit along with the touch panel.
  6. Product: Crestron TSW-1070 -B-S for Wall mounted and TS-1070 -BS for table mounted. or approved equal
- D. 75" Diagonal Display
1. 75" LED display
  2. Ultra HD (3840\*2160) resolution
  3. 16:9 Aspect ratio
  4. 500 Nits Brightness
  5. Provide 5 year warranty for each display.
  6. Provide Chief TS525TU-T articulating mount with each display.
  7. Product: LG 75UH5J-H or approved equal

E. 65" Diagonal Display

1. 65" LED display
2. Ultra HD (3840\*2160) resolution
3. 16:9 Aspect ratio
4. 500 Nits Brightness
5. Provide 5 year warranty for each display.
6. Provide Chief TS525TU-T articulating mount with each display.
7. Product: LG 65UH5J-H or approved equal

F. 55" Diagonal Display

1. 55" LED display
2. Ultra narrow 0.44mm even bezel
3. 16:9 Aspect ratio
4. 500 Nits Brightness
5. Product: LG 55VSM5J or approved equal

G. Table top interactive monitor

1. 24" IPS display
2. FULL HD resolution
3. 10 point multitouch
4. Product: DELL P2424HT or approved comparable product.

H. Digital Media Card Chassis

1. Eight-slot card frame for Crestron DM-NVX-C and DMCF series cards
2. Multi-endpoint 4K video solution
3. 2-space 19-inch rack-mountable
4. Product: Crestron DMF-CI-8 or approved comparable product.

I. AVoIP Converter

1. HDR Network AV Encoder
2. Video Resolution up to 4K@60hz
3. Wall mount in a 2 gang box



4. Provide faceplate.
  5. Audio Formats: primary multichannel up to 7.1 surround, secondary 2-channel LPCM
  6. HDMI IN, Analog Stereo In
  7. Product: Crestron DM-NVX-E20-2G-B-T or approved comparable product.
- J. AVoIP Converter
1. Low-Profile Installation
  2. HDR Network AV Decoder
  3. Video Resolution up to 4K@60hz
  4. Audio Formats: primary multichannel up to 7.1 surround, secondary 2-channel LPCM
  5. HDMI Out, Analog Stereo Out
  6. LAN, USB 2.0, RS-232, IR
  7. Product: Crestron DM-NVX-D30 or approved comparable product
- K. Digital Audio Server
1. 32 x 32 channels of Dante
  2. 12 mic/line level inputs with AEC
  3. 8 mic/line level outputs
  4. Dante™ Network audio interface
  5. 8 Channel USB Audio
  6. RS232 controllable
  7. Product: Biamp Tesiraforte DAN CI or approved comparable product.
- L. Assistive Listening System
1. Provide (1) FM T55 transmitter.
  2. Provide (4) PPA R38N receivers.
  3. Provide (4) EAR 022 surround earphones.
  4. Provide (2) NKL 001 neckloops.
  5. Provide (2) BAT KT6 two bay chargers and rechargeable batteries
  6. Provide (1) ANT 005 remote coaxial antenna
  7. Provide (1) IDP 008 ADA wall plaque

8. Provide (1) RPK 005 rack panel kit
9. Product: William Sound FM 558 PRO or approved comparable product

M. Audio Network Interface

1. Single ethernet port carries Dante audio, Power (POE Class 0)
2. 4 band C/S PEQ on every channel
3. 4 Mic/Line level output
4. 1/3 RU
5. Product: Shure ANI4OUT or approved comparable product.

N. Audio Network Interface

1. Single ethernet port carries Dante audio, Power (POE Class 0)
2. 4 band C/S PEQ on every channel
3. 4 Mic/Line level input
4. 1/3 RU
5. Product: Shure ANI4IN or approved comparable product.

O. Pendant Loudspeaker

1. 8" low frequency driver
2. 55Hz – 20 kHz (-10dB)
3. 150 watts continuous program power
4. 120 degree nominal coverage
5. Product: JBL Control 65 P/T loudspeaker assembly or approved comparable product.

P. Pendant Subwoofer

1. 8" low frequency driver
2. 42Hz – 350Hz (-10dB)
3. 300 watts continuous program power
4. Product: JBL Control 60 PS/T loudspeaker assembly or approved comparable product.

Q. 10-Port PoE Network Switch

1. 48 Port Network Switch
2. Power-over-Ethernet (up to 34.2W) on all channels

3. Total 255W Provided via PoE ports
  4. 1RU
  5. Product: Crestron CEN-SWPOE-10 or approved comparable product.
- R. 48-Port PoE Network Switch
1. 48 Port Network Switch
  2. Power-over-Ethernet (up to 34.2W) on all channels
  3. Total 255W Provided via PoE ports
  4. 1RU
  5. Product: Crestron CEN-SWPOE-48 or approved comparable product.
- S. Gooseneck Microphone
1. Directional (cardioid)
  2. Electret Condenser microphone
  3. Bicolor status indicator
  4. Commshield technology for improve RF Filtering
  5. Product: Shure MX418DC or approved comparable product.
- T. 4-Channel Wireless Microphone System
1. 1RU Rack Mountable Wireless Receiver
  2. Four discrete output channels, XLR connectors
  3. Switchable mic/line output levels
  4. Removable  $\frac{1}{2}$  wave antennas
  5. Provide Shure WL 185 lapel microphone.
  6. Provide Shure ULXD1 bodypack transmitter.
  7. Product: Shure ULXD4Q or approved comparable product.
- U. Wireless Beltpack Transmitter
1. 24-bit/48kHz digital audio
  2. AES 256-bit encryption
  3. 100-meter (300 feet) line-of-sight operating range
  4. Detachable  $\frac{1}{4}$  wave antenna

5. Product: Shure ULXD1 or approved comparable product.
- V. Wireless Handheld Transmitter
1. Gain offset range 0 to 21dB.
  2. Maximum input level 145dB SPL, typical
  3. 20 Hz to 20Khz range with flat response.
  4. AES 256-bit encryption
  5. Product: Shure ULXD2 or approved comparable product.
- W. Handheld Microphone
1. Dynamic Microphone
  2. Frequency Response: 50 to 15,000 Hz
  3. Cardioid polar pattern
  4. Provide Shure ULXD2
  5. Product: Shure SM-58 or approved comparable product.
- X. USB Extender
1. Low profile enclosure
  2. Extends USB up to 100 meters over UTP cable
  3. Up to 30 USB devices
  4. Product: Crestron DM-NUX-R2 / DM-NUX-L2 for regular and DM-NUX-R2-1G-B / DM – NUX-L2 – 1G-B for faceplate or approved comparable product
- Y. Video Conferencing Soundbar
1. 2x 2.5 in (60 mm) full range transducers
  2. 27-Element Digital Array Microphone
  3. 12 MP camera sensor supporting up to 2160p @ 30fps.
  4. AEC (Acoustic Echo Cancellation)
  5. Product: Biamp Parler VBC 2500 or approved equal
- Z. Eight-Channel Power Amplifiers
1. 200W per channel @ 70v
  2. Eight Channels

3. 1 RU rack-mountable
4. Product: QSC MP-A80V or approved comparable product.

#### AA. PTZ Camera

1. 20x optical zoom with 70.2° horizontal field of view
2. 1/2.5-type Exmor R CMOS sensor
3. One EasyIP (Network PoE+) and one HDMI video output
4. Supports up to two EasyIP Mixers or Decoders simultaneously
5. Configure and manually control over IP.
6. Product: Vaddio EASYIP 20 or approved equal

#### BB. 75" Equipment Rack

1. 71.875" useable rack space, 41 RU
2. 75.875" overall height; 29.4" overall depth; 23" overall width
3. Provide security screws.
4. Provide quiet exhaust fan top 4."
5. Provide RSH series rack mount kits as needed.
6. Provide Rack PDU as per specifications above.
7. Provide rack mount UPS to support a minimum of 30 min. backup time.
8. Product: Middle Atlantic BGR-4132 or approved comparable product.

#### CC. Adjustable Podium

1. Dimension : 24"W \* 22.5"D
2. Adjustable Height 40.6" – 50.6"
3. Ergonomic and EIA-compliant workstations
4. Modular equipment rack mounts right or left
5. Equipment rack- mounting 6 RU
6. Provide all mounting accessories for AV equipment as per AV signal flows
7. Product: Spectrum Adjustable Height SLIM Lectern or approved equal

### PART 3 - EXECUTION

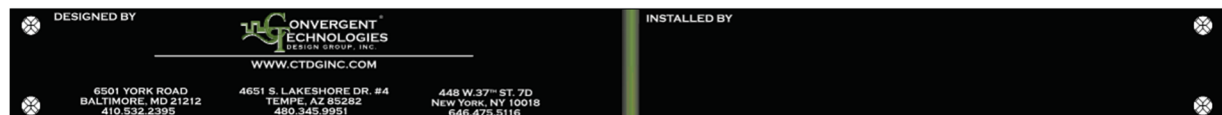
### 3.1 INSTALLATION

#### A. General:

1. All installation work shall be in accordance with, but not limited to, this specification and drawings. Work practices shall be performed in accordance with applicable standards, requirements, and recommendations of Federal and Local authorities having jurisdiction.
2. All discrepancies discovered and any discrepancies which are apparent at the date of submission of bids, shall be immediately corrected without additional charge to the Owner.
3. Clearly label all user controls for intended use and nominal setting. These labels shall be engraved and filled, or equal. "Dymo" labels are not acceptable.
4. All equipment shall be rack mounted supplied with the appropriate rack mount kits.
5. Install in each rack enclosure a power distribution panel. Locate power distribution panel in the first available rack unit.
6. All equipment racks to include removable, locking front doors and a 4" diameter, low-noise fan.
7. All rack and instructor stations shall include "security type" screws to secure rack-mounted components.
8. In rooms containing wireless microphones or an assisted listening system, provide an antenna distribution system inclusive of remote antennas as needed to support complete and consistent coverage throughout the space(s).
9. In rooms containing auto-tracking camera systems, provide one (1) day of manufacturer setup and programming.
10. In rooms containing steerable microphones or loudspeakers, provide one (1) day of manufacturer setup and programming.
11. Provide one (1) spare replacement lamp for each projector specified.

#### B. Physical Installation:

1. Provide system identification plate as shown below. Plate shall occupy the first available rack unit in all AV equipment racks. If more than two (2) racks are positioned together, one (1) plate for every two racks is acceptable. Product: Custom Covid plate # 1LR-CTD-001.



- 2.
3. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Unless granted specific permission by the Owner, install and secure all boxes, equipment, etc., plumb and square.
4. Fastenings, mounting brackets and supports shall be adequate to support their loads with a safety factor of at least five (5). A safety chain or cable will be tied to all equipment suspended from above.

5. All motorized projector lifts shall support their loads with a safety factor of at least five (5) and shall be capable of lowering the equipment to a serviceable height (to at least 48" AFF). When retractable to a position flush with the ceiling surface, provide a matching cover in coordination with the architect and ceiling installer. Center lift covers within ceiling elements and minimize impact to room aesthetics.
6. In the installation of equipment, cable, and other elements, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

### 3.2 AUDIOVISUAL CABLE INSTALLATION

- A. All cables, regardless of length, shall be marked with wraparound cable markers at both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on "as-built" drawings and/or run sheets. The labeling and numbering system shall be coordinated with the Owner.
  1. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-C.
    - a. Cables use flexible vinyl or polyester that flex as cables are bent.
- B. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- C. All wired microphones shall include a 30ft. patch cable with heavy-duty jacket and XLR connectors. Provide local microphone preamp for all wired microphone runs longer than 30ft.
- D. Loudspeakers operating at 4/8/16 ohms shall be installed with 12AWG cable as a minimum size/ diameter.
- E. Wall plate and floor box input/output panels shall be installed with audio/video line drivers for runs exceeding 35ft.
- F. All cabling shall be neatly strapped, dressed, and adequately supported. Any exposed cabling shall be neatly enclosed in a protective covering.
- G. Plastic "zip-ties" shall not be used. Cables shall be bundled utilizing plenum rated hook and loop type cable ties.
- H. Terminal blocks, boards, strips, or connectors shall be furnished for all cables, which interface, with racks, cabinets, consoles, or equipment modules.
- I. AV cabling shall terminate at all floor boxes, wall plates, back boxes, and other infrastructure connection points with patch cables from terminations to source/sink devices (i.e. permanent system cabling may not pass directly through the infrastructure to connect directly to room devices).
- J. All audio signal lines shall be balanced at AV I/O plates. Provide ninety (90) degree connector adapters for all AV cabling at custom AV I/O plates.
- K. All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cables:
  1. Power cables
  2. RGBHV, Video cables and control cables

3. Data cables
  4. Audio cables carrying microphone level signals
  5. Audio cables carrying line signals
  6. Audio cables carrying amplified loudspeaker level signals
- L. Install plenum cable in environmental air spaces, including plenum ceiling.
- M. All cables shall be cut to the length dictated by the run plus the required service loop to permit future equipment movement and relocation. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.
- N. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer. Notify the construction manager if field conditions will interfere with the proper installation of any cables or equipment.
- O. Grounding Procedures: In order to minimize problems from improper grounding and to maximize signal-to-noise ratios, adhere to the following grounding procedures:
1. General: Deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the audio, video, and control systems. Inform the Consultant in the event that there is a deviation from the standard grounding practices prior to performing the work.
  2. Bond the shield of any shielded cable to the grounding busbar in AV rooms and spaces.
  3. System Ground: A single "system ground" shall be established for the system. All grounding conductors shall connect to this system ground. The system ground shall be provided in the equipment rack and shall consist of a copper bar of sufficient size to accommodate all secondary ground conductors.
  4. A copper conductor, having a maximum of 0.1 Ohms total resistance, shall connect the system ground bar to the nearest grounded, metallic electrical conduit of at least 2 inches in diameter. Be responsible for determining if the metallic conduit is properly electrically bonded to the building ground system and provide a drawing as part of the grounding system documentation indicating the grounding pathway.
  5. Secondary system grounding conductors shall be provided from all ungrounded equipment in each area, to the primary system grounding point for the area. Each of these grounding conductors shall have a maximum of 0.1 Ohms total resistance.
  6. Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.
- P. Audio Cable Shields: All balanced audio cable shields shall be grounded at one point only. For ungrounded portable equipment, such as microphones, the shield shall be connected at both ends but grounded at only one end.
- Q. Video Receptacles: All video receptacles shall be insulated from the mounting panel, outlet box, or wireway.
- R. Non-continuous cable supports



1. The AV structured cable shall be supported by its own independent support system.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
3. Suspend cable a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
4. Audiovisual cables shall be supported AFC with adjustable non-continuous cable supports.
5. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of audiovisual cables.
6. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
7. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and the manufacturer's installation instructions.
8. Do not exceed load ratings specified by manufacturer.
9. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

S. Separation from EMI Sources:

1. Comply with BICSI TDMM and ANSI/TIA-569-E for separating AV cabling from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: minimum 5 inches
  - b. Electrical Equipment Rating between 2 and 5 kVA: minimum 12 inches
  - c. Electrical Equipment Rating More Than 5 kVA: minimum 24 inches
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: minimum 2-1/2 inches
  - b. Electrical Equipment Rating between 2 and 5 kVA: minimum 6 inches
  - c. Electrical Equipment Rating More Than 5 kVA: minimum 12 inches
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement
  - b. Electrical Equipment Rating between 2 and 5 kVA: minimum 3 inches
  - c. Electrical Equipment Rating More Than 5 kVA: minimum 6 inches
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: minimum 48 inches
6. Separation between Communications Cables and Fluorescent Fixtures: minimum 5 inches

### 3.3 REPAIR/RESTORATION

- A. Any damage to any installed work or product caused by the unpacking, transporting, assembly, connecting, or configuring of the product shall be repaired at no charge to the Owner.

### 3.4 FIELD QUALITY CONTROL

- A. Once installed and the System Checkout is complete, the system shall be demonstrated as operational to the Owner.
  - 1. If the AV system fails to meet the requirements of this document or those stated by the technical documentation, then the Owner shall reject the installed system and the contractor shall be given notice (either oral or in writing) to correct the failure.
  - 2. If unable to overcome repeated performance deficiencies within thirty (30) days, and if requested to do so by the Owner, remove the equipment and replace at no expense to the Owner.
  - 3. No warranties shall begin until the Owner has authorized final acceptance in writing.
  - 4. Right to Revoke Acceptance: If any equipment and/or goods which have been previously accepted, specifically or by the making of payment, are found to have defects, damage, or deficiencies, or fail to conform to the specification, for any cause not attributable to the Owner, the Owner may revoke acceptance.
- B. Conduct pre-acceptance tests
  - 1. Perform all system performance checks on the installed systems prior to final acceptance testing. The Owner / AV Consultant may witness the pre-acceptance tests. The Owner / Architect may inspect and operate system components in order to evaluate installation progress and technical compliance prior to acceptance testing.
- C. Contractor System Checkout
  - 1. Perform system checkout before acceptance tests are scheduled. Furnish all required test equipment. Perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification.
  - 2. During performance testing, all equipment shall be operated under standard conditions as recommended by the manufacturer.
  - 3. Test all audio and video systems for compliance with the Performance Standards using test procedures that follow later in this specification.
  - 4. Maintain documentation of all performance tests for reference by Consultant during System Acceptance.
  - 5. At the conclusion of the tests, return all equipment settings to previously calibrated positions.
  - 6. Provide written records of all test results in spreadsheet form.
  - 7. Check all control functions, from all controlling devices to all controlled devices, for proper operation.

8. Adjust, balance, and align all equipment to optimize quality and meet the manufacturers' published specifications. Establish and mark normal settings for all level controls and record these settings in the "System Operation and Maintenance Manual."
9. Provide testing results and settings for all equipment and systems to the AV Consultant at least three (3) business days prior to System Acceptance Testing.
10. Provide the AV Consultant with all test results, manuals, software, as-built documentation, etc. prior to acceptance testing.
11. Inform the Owner and AV Consultant that the systems are ready for the AV Consultant to perform System Acceptance Testing. The system shall be considered ready for acceptance testing when the following conditions are met:
  - a. AV Contractor has pre-tested all systems such that all sub-systems, functions, software, and equipment are debugged and operational.
  - b. AV Contractor has supplied the AV Consultant with the written test results and documentation as listed above for all rooms and systems.
  - c. AV Contractor has supplied the AV Consultant with closeout (manuals, training materials, and other as-built) documentation revised to reflect comments and/or revisions arising from the review cycles listed elsewhere within this document.
12. Should the systems not be ready for testing by the AV Consultant at the date(s) and time(s) indicated by the AV Contractor, system acceptance testing may be rescheduled at the sole discretion of the AV Consultant. Pay for the labor and expenses of the AV Consultant and other project team members assembled at the project site for the purpose of system acceptance testing for the date(s) of the original scheduled testing plus the labor and expenses of the AV Consultant and other project team members for the rescheduled testing date(s). The labor rate for the AV Consultant shall be a flat rate of \$200.00/hour including travel time. Other project team member labor costs shall be at their respective published rates. The PM and/or Owner shall be entitled to deduct any money owed to the Owner, PM, AV Consultant, or other project team members under this contract from any sum which may become due or is payable to the AV Contractor under this Contract for the purposes of satisfying the charges listed above.

#### D. Final Acceptance Test

1. Testing will be performed with the Owner (or its designees) present to determine that the AV system equipment satisfies the manufacturers' performance specifications and that the installed AV system satisfactorily performs the functions required by this specification. Conduct formal pre-acceptance tests prior to the Owner's acceptance testing to ensure that the performance and functional specifications are satisfied by the installed system and the system is ready for the Owner's acceptance. Verify in the owner's presence that the installed audiovisual system satisfies the performance and functional requirements through formal acceptance testing. Be responsible for staging each room to be tested and shall have sufficient personnel on site to run multiple systems at once (not less than three (3) personnel).

#### E. Test Equipment

1. Assemble the following test equipment (or equivalent) on site:
  - a. Audio and Video cables, terminations, adapters, etc.
  - b. Blu-Ray (if applicable)
  - c. HDMI/DVI Test Signal Generator
  - d. Waveform Monitor
  - e. PC/Laptop/Tablet

## F. Audio System Testing

1. Absolute Impedances
  - a. Set any loudspeaker level controls at zero attenuation. Measure absolute impedance value of each loudspeaker line at 250, 500, 1000, 2000, 4000 Hz without the amplifier connected but with all loudspeakers connected. Impedance must be greater than or equal to the rated load impedance of the respective amplifier. Check the resistance of lines to all loudspeakers and microphone receptacles with the receptacles open and short-circuited.
2. Hum and Noise Level
  - a. Test overall hum and noise. System noise should be at least 60 dB below the rated power output of each amplifier with the amplifier controls when set for both full output and for optimal signal-to-noise ratio.
3. Parasitic Oscillation and RF Pickup
  - a. Set up the system for each specified mode of operation.
  - b. Ensure the system is free of spurious oscillation and RF pickup in the absence of any input signal in each mode of operation and with the system driven momentarily to full output at 160 Hz.
4. Buzzes, Rattles, Distortions
  - a. Apply high quality music signal to the system. Adjust the sound system to its maximum usable sound pressure level, and verify clipping is not occurring at any system element.
  - b. Apply a sinewave sweep from 50 to 5,000 Hz, 6 dB below full amplifier power.
  - c. For both the music and sine sweep sources, listen carefully for buzzes, rattles and objectionable distortion.
  - d. Correct all causes of such defects. If the artifact is not caused directly by audiovisual system components, promptly notify the architect indicating cause and suggested corrective procedures.
5. Implement any automated emergency system mute functions required by local regulations.
6. Equalize all audio systems for maximum gain before feedback in all room configurations. Adjust all system inputs for consistent operating levels (within 6dB RMS).
7. Within each audio system, ensure all loudspeakers are installed with the same relative polarity and absolute polarity consistent with each input source device.
8. Verify coverage is consistent throughout audience areas. Adhere to ANSI/INFOCOMM standard 1M-2009, *Audio Coverage Uniformity in Enclosed Listener Areas*. Perform separate tests for each audio system in the project and be responsible for modifying or augmenting systems as required to meet the referenced standards.
9. Verify that audio/video synchronization is maintained for all content sources and destinations.
10. Record all system settings and include in the Systems Operation manuals.

## G. Video System Testing

1. Signal Paths
2. Utilizing a NTSC color bar generator and waveform analyzer with the video signal set at 100% saturation and 75% amplitude check that the video performance specifications are

met at the display devices from all source inputs to all system outputs. Connect the combined waveform monitor/vectorscope to a final output point, e.g. an input to a picture monitor or video projector. Ensure that the test signal is routed to the selected output(s).  
Level Balance

- a. Adjust all video projection equipment to fill the entire screen area and to produce the best image possible.
- b. Adjust all video sources and displays to produce the best image possible.
- c. Verify that colors appear uniformly on all video displays.
- d. Verify that all pixels operate correctly, consistently meeting or exceeding the manufacturer's specifications. Replace any equipment with pixel failures (dead or excessively bright pixels).
- e. Record all system settings for inclusion in the Systems Operation manuals.

#### H. RGBHV System Testing

1. For all RGBHV inputs, connect the RGBHV output of the signal generator to a floorbox/table/rack connector and select the SMPTE bar with "pluge pulse" signal at the following computer scan rates:
  - a. 1024 x 768 XGA
  - b. 1280 x 1024 SXGA
  - c. 1366 x 768 WXGA
  - d. 1400 x 1050 SXGA+
  - e. 1440 x 900 WXGA+
  - f. 1600 x 1200 UXGA
  - g. 1920 x 1080
  - h. 1080i
  - i. 1080p
  - j. 720i
  - k. 720p
2. Check that the image is correctly displayed at all system outputs including the monitor(s) and/or by the video projector.
3. Repeat items 1 and 2 using Crosshatch, Checkerboard, and H Pattern Signals.

#### I. Digital Video System Testing

1. For all digital video inputs, connect the output of the digital signal generator to each connection at the following resolutions:
  - a. 640 x 480p60 24 MHz Pixel Clock
  - b. 1024 x 768p60 63.5 MHz Pixel Clock
  - c. 1280 x 768p60 68 MHz Pixel Clock
  - d. 1280 x 768p60 79.5 MHz Pixel Clock
  - e. 1280 x 1024p60 109 MHz Pixel Clock
  - f. 1920 x 1080p60 (SMPTE reduced) 148.5 MHz Pixel Clock
  - g. 1920 x 1200p60 (blanking reduced) 154 MHz Pixel Clock
  - h. 1600 x 1200p60 162 MHz Pixel Clock
  - i. 1920 x 1080p60 (VESA) 173 MHz Pixel Clock
  - j. 1920 x 1080p60 (SMPTE rd.) Deep Color 148.5 MHz Pixel Clock
  - k. 1280 x 768p60 3D HDTV
  - l. 1920 x 1080p24 3D HDTV
  - m. 1920 x 1200p75 Deep Color
  - n. 2560 x 1600p75
  - o. 3840 x 2160p60
  - p. 4096 x 2160p30
  - q. 4096 x 2160p30 Deep Color

2. Check that the image is correctly displayed at all system outputs including the monitor(s) and/or by the video projector. Display resolution shall be limited only by the manufacturer specified capabilities of the display or source device. Verify that all display resolutions appear correctly for each system source and destination without artifacts, including but not limited to pixel shift, geometric distortion, letterboxing, pillarboxing, and windowboxing.
3. Focus all images and adjust as required to eliminate any stretching, keystone, or other distortion. In no instance shall an image be mapped or shaped to an unusual surface unless explicitly defined in the project documents. Repeat items 1 and 2 with an HDCP compliant source to all outputs simultaneously to verify compliance.
4. Disable CEC for all source HDMI connections to switchers, scalers or other video processors.
5. Configure or disable EDID as required for consistent, error-free operation.

#### J. Optical Projection Systems

1. All optical projection systems shall meet the following performance standards:
  - a. The total averaged light output from a projector, in lumens, shall be within  $\pm 15\%$  of that specified by the projector manufacturer.
  - b. The light fall-off from the center of the projected image to all four corners, as measured at the projected image plane, shall not exceed 35%. The light intensity shall be measured at all five positions of the projected image after the projector has been adjusted to provide the light output as specified above.
  - c. The "corner" locations shall be defined as the four points determined by intersecting lines drawn 5% of the distance in from the focused edges of the image.
  - d. The light meter used for the above measurements shall be properly calibrated foot-candle (or lux) meter and shall be cosine-corrected.
  - e. Projectors, lenses, and mirrors shall be solidly mounted and braced so that there will be no observable movement in the image induced by motor vibration or other mechanical operations.

#### K. Qualification Methods

1. Three methods will be used to qualify the AV system for acceptance.
  - a. Inspection - A critical observation of qualifying factors, such as quality of workmanship, equipment placement, routing of cables, adequacy of technical documentation, etc., that do not lend themselves to demonstration or measurement.
  - b. Demonstration - A process of showing by reason or evidence that a given condition clearly satisfies the requirement.
  - c. Measurement - A process of determining the actual dimension, capacity, or amount of something, by measuring using calibrated standards.
2. Acceptance of the work of this section shall occur after completion of corrections and adjustments required by "Punch List" (as generated during demonstration and acceptance testing of completed installation).
3. Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to acceptance, without incurring any obligation to accept any equipment or completed systems until punch list work is complete and systems comply with the contract documents.

### 3.5 SOURCE QUALITY CONTROL CATEGORY RATED CABLING

- A. Factory test F/UTP and UTP and optical fiber cables on reels according to ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.
- B. Factory test F/UTP and UTP cables according to ANSI/TIA-568.2-D.
- C. Factory test multimode and singlemode optical fiber cables according to ANSI/TIA-526-14-A and ANSI/TIA-568.3-D.
- D. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 27 41 00

## SECTION 27 41 13 - MULTIMEDIA SYSTEMS FLOORBOXES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Multimedia Systems Floorboxes

#### 1.2 PERFORMANCE REQUIREMENTS

- A. General: Floor boxes provide interface between power, audiovisual, and telecommunications cabling in concrete floors and decks at workstations or at activation locations requiring power, audiovisual, or communication device outlets.

1. ADA Compliance: Flush-mounted floor device outlets shall not create tripping hazards.

- B. Floor Mounted Connector Assembly: Watertight, rubber cable pass thru gasketed door and cover assembly, utilizing basket and connector mounting panel inserts. Customize cover/door opening so that cable pass-thru will accommodate the bundle of AV cabling specified, while maintaining the ability to fully close with cables connected.

- C. Labeling: Floor boxes shall bear the "cULus mark" issued by UL for units complying with both US and Canadian Standards.

- D. Standards: Comply with the following:

1. UL 514A
2. National Electrical Code

#### 1.3 SUBMITTALS

A. Related Sections

1. Comply with requirements of Section 01 33 00, "Submittal Procedures."

B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:

- a. Cover Sheet

- 1) Include name of supplying contractor and project name.
- 2) Include submittal and revision number.

- b. Detailed Bill of Materials

- 1) Include a listing of: component quantities, equipment manufacturers, model numbers, descriptions of each component being supplied, and the specification paragraphs or drawing sheets that correspond to each product.
- 2) The bill of materials shall be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
- 3) Failure to provide this information will result in the rejection of submittals.

- c. Product Data



- 1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
    - 2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
    - 3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight. All optional components and selections shall be clearly indicated.
    - 4) Indicate floor box models, trim, finish, and accessories.
  2. Informational Submittals
    - a. Submit Manufacturer's installation instructions.
  3. Partial submittals, or submittals comprised of multiple PDF files, will not be accepted.
- C. Photographs
1. Submit photographs of each placed floorbox with associated conduit prior to slab pour.
- D. Shop Drawings
1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
    - a. Title Sheet with sheet index and symbols legend
    - b. All panels, plates, and designation strips, including connectivity, layout, labeling, and details relating to terminology, engraving, finish and color
    - c. All unusual equipment modifications
    - d. Equipment location drawings, dimensioned to column lines
    - e. Include detailed elevation drawings, showing conduit runs and associated box knockout locations
    - f. Furniture coordination drawings, depicting planned cable pathway to furniture raceway or outlets, where applicable
  2. Drawings should be at project standard scale and clearly legible.
  3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.
- E. Form
1. Submit all materials for review as described above, specifically referenced to the specification paragraph number (where applicable).
    - a. Submit all drawings on sheets of one size, preferably the project standard size.
    - b. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.
  2. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following submittals shall not be considered partial:
    - a. Personnel
    - b. Milestones
    - c. Conduit Verification Statement and Notifications
    - d. Rigging and Mounting Drawings
    - e. As-Built Documentation

3. Product Data and shop drawings must be submitted together in order to be reviewed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  1. Legrand/Wiremold
  2. Approved equal
- B. Multimedia Systems Floorbox:
  1. In-slab: EFB8S-OG
  2. Raised floor: EFB8S
  3. Fire classified: EFB8S-FC

### 2.2 MATERIALS

- A. Door and Cover: Not lighter than 11-gauge steel with integral, self-trimming carpet trim ring. Mount trim ring flush with floor covering. Secure with security socket head screws.
  1. Finish: Satin black coating
  2. Trim: Door, cover, and integral trim ring shall have radiused corners.
- B. Device Plates
  1. Provide device plates as detailed on drawings.
  2. Provide blank plates for all unused openings.
- C. In-slab Boxes
  1. 11-gauge steel, 15 13/16 inches by 12 3/4 inches by 6 1/16 inches deep
  2. Mount on manufacturer's backbox.
- D. Raised floor Boxes
  1. 11-gauge steel, 15 13/16 inches by 12 3/4 inches by 6 1/16 inches deep
  2. Provide toggle clamps to allow box to be secured to raised floors.
- E. Fire classified floor Boxes
  1. 11-gauge steel, 15 13/16 inches by 12 3/4 inches by 6 1/16 inches deep
  2. Provide fire-rated backbox and install per manufacturer's instructions.

- 3. All boxes shall maintain a minimum of 1 hour of fire rating.
- F. Provide pull strings in each conduit at floor box location. Coordinate conduit to box knockout location with telecommunication cabling and audiovisual systems requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. The minimum concrete pour depth shall be 7 inches less decking. For pour depths less than 7 inches, provide structural bracing and firestopping as necessary.
- B. With Installer present, verify that manufacturer's requirements for floor opening and infrastructure conditions have been satisfactorily met. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Arrange for jobsite approval of the equipment prior to installation.
- B. Verify exact locations of floorbox installation.
- C. Coordinate all box locations with furniture onsite prior to installation.

### 3.3 INSTALLATION

- A. Install equipment in compliance with approved shop drawings and manufacturer's installation instructions.
- B. Install in position and relationship to adjoining work indicated, securely anchored to supporting structure, sealed and finished, and in a manner which produces a level box with square, plumb, and straight edges.
- C. Coordinate installation with floor covering to finish each floor box. Install floor covering with oversized cable management pop-up pass-thru in top, matching surrounding floor covering in cover insert.

### 3.4 ADJUSTING

- A. Adjust door/cover for proper operation.

### 3.5 PROTECTION

- A. Protect installed equipment in original undamaged condition until Substantial Completion. Replace damaged components for units that cannot be repaired prior to Substantial Completion.

END OF SECTION 27 41 13

## SECTION 281300 - ELECTRONIC ACCESS CONTROL

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Access control.
2. Stranded power and control cable.
3. Cable connecting hardware, patch panels, and cross-connects.
4. Cable management system.
5. Cabling identification products.
6. Grounding.
7. Pathways.

B. Related Sections

1. 271000 – Telecommunications Structured Cabling
2. 282300 – Video Surveillance Systems

C. System Requirements

1. Install and integrate a completely functional Access Control, Intrusion, Video Surveillance Systems and related security hardware including power supplies, UPSs, server/client software, licenses, related security hardware and Owner Furnished Equipment as specified and as detailed in associated contract drawings.
2. Configure local access panels in various telecommunication rooms (TR) and the Server's computer system to communicate with one another.
3. Enter security system databases hardware configuration.
4. Test security system communication and operation in accordance with the specification.
5. Train operators and the system managers.

#### 1.2 REFERENCES

- A. The Codes and Regulations listed below form a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:

1. UL 294, UL 1076, ULC
2. CE
3. FCC – Part 15, Part 68
4. NFPA 70, NEC
5. IEEE, RS 170 variable standard
6. RoHS

- B. Where more than one code or regulation is applicable, the more stringent shall apply.

- C. Cable and equipment installation, identification and termination shall be performed in accordance to the applicable codes above.

#### 1.3 DEFINITIONS

- A. ADA: Americans with Disabilities Act
- B. Bid: Herein, used interchangeably with "proposal"
- C. Demarc: "Demarcation Point" marking the location where communications facilities owned by one organization interface with that of another.
- D. DVR: Digital Video Recorder
- E. GUI: Graphical User Interface
- F. LAN: Local Area Network
- G. IP: Internet Protocol
- H. IR: Infrared
- I. NIC: material and work which is Not In Contract and for which the Installer is not responsible except as otherwise detailed herein.
- J. NVR: Network Video Recorder
- K. OFE: "Owner Furnished Equipment" which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.
- L. OFCI: "Owner Furnished Contractor Installed" Equipment which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.
- M. OSP: Outside Service Plant
- N. PoE: Power over Ethernet
- O. TR: Telecommunications Room
- P. UPS: Uninterruptable Power Supply
- Q. The term "shall" is mandatory.
- R. The term "will" is informative.
- S. The term "should" is advisory.
- T. Term "provide" means furnish and install.
- U. Security Consultant: Convergent Technologies Design Group, Inc.
- V. SMS: Security Management System
- W. Bidder: Qualified firm intending to tender a bid on the systems described herein.
- X. Construction Manager (CM) or General Contractor (GC): The representative responsible for general building construction and onsite coordination between sub-contractors

#### 1.4 BID PROPOSALS

##### A. Itemized Bid Response

1. Each piece of equipment shall be individually priced and submitted with Bid Proposals. Provide itemized bid response to include equipment description, manufacturer, model number, unit price, and quantity. All equipment prices shall reflect required modifications and accessories as needed for a complete and functioning system.
2. Non-equipment charges shall be outlined separately as a single line item. A sum of the access control system total cost shall be provided with the bid proposal.
3. Lump sum bids will not be accepted.

##### B. Contractor Qualification

1. Demonstrate at least three (3) years' experience in the fabrication, programming, assembly, and installation of Access Control and intrusion systems of similar magnitude and quality as specified for the subject job. Submit documentation to this effect with the bid response. Be an authorized sales and service center for all listed components and offerings in this specification.
2. References: Furnish no less than three (3) references for installations of similar size (dollar amount & quantity of spaces receiving integrated technology) and scope, performed throughout the same region of the project address within the past three (3) years. At a minimum, reference information will include the reference company or institute name, contact person's name and title, telephone number, address, and detailed project description, project manager's name, and

contact information of the organization that is responsible for day-to-day operation of the access control system installation.

3. Be an Enterprise level dealer of the specified system.

4. Have Microsoft Certified Programmers on staff.

5. Bidders shall include as part of the bid response the following items:

- a. List of all technical personnel factory-certified on specified product manufacturer.
- b. Letter of approval from the manufacturer indicating compliance with qualification requirements.
- c. Installation schedule with proposed manpower assignments.
- d. Resumes for project manager, lead engineer and all ASIS certifications for this project.
- e. Training certificates for design, engineering and installation of the proposed products shall be submitted with the proposal.
- f. Service Dispatch outline containing the type of service program used for dispatching and tracking service calls.

C. Alternate Proposals

1. Any proposed alternate equipment choices should be requested in writing prior to the proposal submission for approval. Each item on the alternate equipment list must be accompanied by catalog cut sheets and technical specifications.

D. Non-Equipment Charges, Including but not be limited to:

1. Engineering: Including all required design drawings, run sheets, instruction manuals, step-by-step user guide, etc.
2. Pre-Installation: Work performed on the Installer's premises including all fabrication, modification, assembly, rack/cabinet wiring, etc.
3. Installation: Including all on-site installation and wiring, shop drawing, coordination and supervision, testing, checkout, Owner training, etc., performed on the Owner's premises.
4. General and Administrative: Including all shipping, insurance, and guarantees.

E. Owner Furnished Equipment (OFE, OFCI)

1. Identify any Owner Furnished Equipment assumed in the Bid Proposal to be installed and integrated under this contract. Identify all assumed Owner Furnished equipment within each room/space type that will be required to complete the access control systems installation.

F. State of the Art Development

1. Supply only the manufacturer's latest developed product. In cases where product development surpasses the criteria of the specification, inform the Architect and make the newer product available to the project at no additional cost. In no case shall discontinued or obsolete equipment be acceptable. The same requirement applies to software programs developed/updated during the warranty period.
2. Should a manufacturer discontinue a specified product, provide the manufacturer's recommended replacement at no additional cost to the owner. Should the manufacturer have no direct replacement product, the access control contractor shall propose a product of equal or greater specification from an alternate manufacturer at no additional cost to the owner.

3. Should a product recall by a specified manufacturer require temporary or permanent replacement of a product specified under this section, notify the Architect at the earliest possible time and arrange to replace the product in question as quickly as possible.
  - a. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
  - b. Equipment defect or intended recall shall not relieve the access control contractor from any contractual obligations with regard to delivery schedule of product.
  - c. Under no circumstances shall arrangement for alternate product require the Owner to accept superseded equipment except on a temporary basis.

G. Service Contract

1. Submit the costs for a one-year service contract, renewable for up to three years, which shall commence with the completion of the two-year warranty period. These contracts shall be fixed-cost, and can be accepted at the option of the Owner.
2. The service contract shall include all of the services provided during the warranty period, including complete replacement or repair of defective equipment.

1.5 QUALITY ASSURANCE

A. Coordination

1. 282300 for integration requirements of Video Surveillance system components.
2. 271000 for pathways, cabling locations, colors, termination ports, and all OSP Demarc locations related to access control systems.
3. Test and verify structured cabling installed to support the access control system.
4. Coordinate layout and installation of Access Control Systems equipment with Owner's security representative.
  - a. Meet jointly with Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
  - b. Record agreements reached in meetings and distribute them to other participants and the project Architect for design team distribution.
5. Coordinate this Section with work of other Project Manual sections and associated trades.
6. Specific references, herein, requiring coordination of certain work shall not obviate responsibility for other required coordination.

B. Unspecified Equipment and Material

1. All equipment and materials not specifically addressed on the drawings or in this document and required to provide complete and functional access control system shall be provided in a level of quality consistent with other specified items.

C. Standards and Codes

1. Comply with
  - a. Local, state and federal codes
  - b. Applicable National Electrical Code
  - c. American National Standards Institute

d. Underwriters' Laboratories, Inc. standards.

2. All equipment, material, accessories, and loose items provided by Contractor shall be new and shall conform to applicable requirements of the above-mentioned agencies.
3. If required by local authorities, provide certificates and labels indicating compliance with above-mentioned codes and standards where applicable.

D. Point of Contact

1. Designate to the Owner in writing, the responsible person who shall ensure timely and consistent communication with the Owner on progress of the contract. The designated representative shall have full knowledge of all engineering and production procedures and shall report status of the installation and upcoming work plans to the Owner's Project Manager and Consultant on a weekly basis.
2. Project manager shall have successfully managed not less than two (2) projects of similar size and scope (as defined in previous sections). Bid submission shall detail the percentage of time that the project manager and other key personnel will be involved with the project.

1.6 SCOPE OF WORK

A. Provide the following in accordance with Specifications and Drawings

1. Submittals delivered in a timely manner as described hereinafter.
2. Verification of dimensions and other conditions at project site. Review conduit system as shown in electrical section of building construction documents and, where applicable, as built conditions. Notify Consultant, Architect, GC, and EC within four weeks after award of contract of any deficiencies or inadequacies in conduit system design.
3. Detailed design of access control system GUI, system "maps," including remote-control accommodations.
4. Power distribution and battery backup within equipment racks and wall fields including power connection to electrical outlets as described in electrical section of building construction documents.
5. Incidentals necessary for a complete working system.
6. Initial testing and adjustments, demonstration of system for approval, participation in acceptance tests, final adjustments as required.
7. Record Documents, "As-Built" drawings and Owners Manual.
8. Training of operating personnel.
9. Notify appropriate parties of conflicts in a timely manner.
10. Work cooperatively with other trades to resolve conflicts.

B. Special Insurance

1. Provide insurance fully covering all equipment against loss, damage, and theft during shipment, storage, installation, testing, adjustment and demonstration.

1.7 SYSTEM DESCRIPTION

- A. All building and room access control systems, equipment, and accessories shall be compatible with the current access control system. All auxiliary accessories or supporting devices shall be fully compatible with and able to integrate with the existing access control system.



- B. The SMS shall be able to seamlessly interface with and monitor intelligent system controllers, reader interface modules, I/O panels, burglar alarm panels, burglar alarm panel receivers, biometric devices, personal protection devices, intercom systems, fire alarm panels (secondary monitoring only), building management systems and digital/network video recorders and software.
- C. The SMS shall be able to communicate with intelligent system controllers via RS-485, RS-232, TCP-IP/Ethernet.
- D. Design Intent
  - 1. Provide a complete and functioning access control system inclusive of all hardware, software and training to meet or exceed the performance features outlined in this document.

## 1.8 SUBMITTALS

### A. Related Sections

- 1. Comply with requirements of Section 01 33 00 - Submittal Procedures.

### B. Submittal Data

- 1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
  - a. Cover Sheet.
    - 1) Include name of supplying contractor and project name.
  - b. Detailed Bill of Materials.
    - 1) Include a listing of: component quantities, equipment manufacturers, model numbers, and description of each component being supplied, and the specification paragraph or drawing sheet that corresponds to the product.
    - 2) The bill of materials shall include page numbers for each product data sheet and be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
    - 3) Failure to provide this information will result in the rejection of submittals.
  - c. Product Data.
    - 1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
    - 2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
    - 3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight.

- d. Authorized Distributor Certificate.
  - 1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.
- e. Partial submittals, or submittals comprised of multiple PDF files, will not be accepted.

C. Shop Drawings

- 1. Prior to fabrication submit contractor generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
  - a. Title Sheet & Symbols Legend
  - b. Riser Diagram: Provide riser diagrams of the access control systems and any other systems specified herein.
  - c. Block Diagrams: Submit block diagrams for each system indicating connections of equipment and indicating equipment types and model numbers.
  - d. Field Devices: Submit details on items such as alarm detectors, contacts, and card readers including their appearance and performance, specifications, and exact locations. Include on shop drawings the reader locations and show the reader controller to which they are assigned. Show the devices they work with, such as electric locks, local audible alarms, door contacts, etc.
  - e. Coordination Drawings: Elevation Details of wall fields in Telecommunications Rooms showing the relationship of rack mounted elements inclusive of Owner provided equipment (labeled as such).
  - f. All unusual equipment modifications.
  - g. Front mechanical drawings of each equipment rack.
  - h. Equipment location drawings.
  - i. Cable labeling plan.
  - j. Floor Plans, RCPs and Elevations: Show planned location for all elements and cable routing. Drawings should be at project standard scale and clearly legible.
  - k. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.

D. Form

- 1. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following Submittals shall not be considered partial:
  - a. Personnel
  - b. Milestones
  - c. Conduit Verification Statement and Notifications
  - d. As-Built Documentation
- 2. Product Data and Shop drawings must be submitted together in order to be reviewed.

E. Weekly Reporting

1. Commencing with project award, provide weekly status reporting of milestone task status, anticipated completion date, and related memo notes for the following tasks:
  - a. Submittals
  - b. Infrastructure verification
  - c. Pre-wire status
  - d. Equipment Procurement
  - e. Shop fabrication
  - f. Remote control system design
  - g. Installation and Terminations
  - h. Field testing and pre-acceptance testing
  - i. Final acceptance demonstrations
  - j. Owner training
  - k. First owner use
  - l. Open Coordination Items and Questions
2. See below for a partial example of an acceptable weekly reporting list.

Project: <i>Project Name</i>							
Location: <i>Project Location</i>					Date: <i>Form Delivery Date</i>		
Project Manager: <i>Project Manager</i>					Delivered by: <i>Form Delivered By</i>		
		Projected Completion:		Status:		Notes:	
Infrastructure Verification:		<i>6/1/2011</i>		<i>Complete</i>			
Submittals:							
	<i>Product Data</i>	<i>8/1/2011</i>	<i>Complete</i>				
	<i>Drawings</i>	<i>8/1/2011</i>	<i>Complete</i>				
	<i>Personnel (etc.)</i>	<i>8/1/2011</i>	<i>Complete</i>				
RFIs:							
	<i>12</i>	<i>8/25/2011</i>	<i>Received</i>		<i>Implementing</i>		
	<i>178</i>	<i>9/6/2011</i>	<i>Pending</i>		<i>Projector Screen Clearances</i>		
Installation Status by Space							
Room		Equipment					
Name	Number	Pre-Wire	Order	Receive	Install	Test	Notes:
<i>Example 1</i>	<i>105</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>60%</i>	<i>0%</i>	<i>Re-programming</i>
<i>Example 2</i>	<i>135</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>90%</i>	<i>0%</i>	<i>Other Notes Here</i>

F. Personnel

1. Provide, in writing, within two weeks after award of Contract, the names, mailing address, phone numbers with extensions, email addresses and paging service numbers (if available) of the following project personnel:
  - a. Project Manager
  - b. Lead Systems Engineer
  - c. Field Foreman

2. Within four weeks after award of Contract, submit statement confirming that Contractor has reviewed the conduit system as designed in building construction documents and, where applicable, as built.
3. Notify Consultant, General Contractor, Architect or Electrical Contractor of deficiencies or inadequacies, if any, in conduit system design or installation. If none, so indicate.
4. Absent conduit verification by Contractor and after installation of conduit as designed, Contractor shall assume costs of equipment, materials, labor and engineering, including services of owner's representative(s) in designing and/or verifying revised wiring approach(es) as relate to providing a fully functional system using conduit as designed or as revised at the discretion of the owner.

## 1.9 CLOSEOUT SUBMITTALS

- A. At the completion of the installation, but before Final Acceptance, provide for review and approval the following, in compliance with Division 1 Section *Closeout Procedures*.
  1. Operation and Maintenance Manuals:
    - a. Equipment manufacturer's operation and service manuals for each make and model of equipment.
    - b. System Operation Manual. Produce a manual specifically for the subsystems detailed herein. The manual shall describe all procedures necessary to activate each system to provide for the functional requirements, except as specifically excluded by the Owner. This section shall provide a simple "How-to" users guide for the procedures needed to operate the system. This document shall contain a section on operating the systems equipment in the event of control system failure. Control system touch panel layouts shall be accompanied by narrative text describing "step-by-step" function engagement.
- B. Warranty
  1. Provide list and dates of activation of equipment warranties
  2. Provide original manufacturers' certificates.
- C. As-built Drawings
  1. Include contractor generated (mark-up of contract documents is not acceptable) digital record diagrams for all systems including, but not limited to:
    - a. Schematic wiring diagrams with cable markings.
    - b. Internal wiring diagrams of the equipment rack and enclosures.
    - c. Custom equipment modifications.
    - d. Final test results and nominal settings for all adjustable controls.
- D. Software Passwords
  1. Software Passwords Schedule (i.e., a spreadsheet listing the manufacturer, model number and location in the Facility, of each piece of access control equipment, the software for which is password-protected).
  2. Provide to Owner's Representative as a secure document separate from Operating and Maintenance Manuals and As-Built Drawings.
- E. Editable Control System Code

1. Provide the final control system code in an editable format.

F. Laminated Instruction Cards

1. Provide 8 ½ x 11 Instruction cards, approved by the Owner. Laminate step-by-step instructions outlining system operations for the access control system. Provide editable file of card to Owner.

1.10 DELIVERY, STORAGE, HANDLING, AND STAGING

- A. Supply, transport, deliver, unload, move to the installation location, unpack, place, assemble, secure, connect, and install all equipment needed to complete the installation. Be responsible for transportation, parking, delivery, and on-site storage of the system's equipment. Be responsible for all transportation of personnel to and from the site.
- B. Reconfirm before delivery that hallways, stairways, passages, doorways, rooms, entries, elevators and foyers are of sufficient size to accommodate the passage and installation of the equipment and systems. Off-site pre-staging of goods is encouraged.
- C. The Owner's acknowledgment of delivery of goods and any payment made on account of such delivery shall not constitute acceptance (partial or otherwise) and shall not diminish obligations as specified.
- D. The actual dates of delivery shall be under the absolute control of the Owner. The dates and times for delivery/installation are critical to the successful completion of the project. Deliveries shall normally be accepted only Monday through Friday 8:00 a.m. to 4:00 p.m. In the event it becomes necessary for goods to be installed outside these hours comply with the instructions of the Owner. Deliveries attempted outside these hours without prior consent of the Owner may be turned away. Comply with all instructions of the Owner and the Contractor concerning time of arrival at the site; which entrance shall be utilized for delivery; routes to be taken to reach the installation location; and other matters relating to the orderly and timely installation of the system.
- E. Installation shall commence immediately upon delivery of materials to the jobsite, except as directed by Construction Manager. Time required from delivery date to completion of project shall be in accordance with the approved schedules.
- F. Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- G. Do not deliver or install equipment until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.11 SYSTEM TRAINING

- A. Training: Provide training in the operation and maintenance of the system for personnel designated by the Owner. Record owner training sessions on DVD or other agreed upon media and make training videos available to the owner at no charge. The training shall be organized as follows:
  1. Two (2) two-hour training classes for system technical operation and maintenance. This class shall cover the following topics:
    - a. Review of signal flow diagrams.
    - b. Review of all equipment functions, relevant to the function in this system.
    - c. Review of initial equipment settings.
    - d. Demonstration of all functional connections from a user perspective.
    - e. Review & demonstration of control system software replacement/upgrade procedures.

- f. Review of manufacturers' recommended routine maintenance procedures.
  - g. Review applicable badge creation procedures.
- 2. Four (4) days of advanced user training for systems operations. This shall include day-to-day operation as well as in-depth review of system capabilities and programming.
  - 3. Training may take place at any time (chosen by the Owner) after the systems are operational, up to a year following system acceptance.
  - 4. Close out submittals shall be provided prior to any training classes.
  - 5. Coordinate detailed specifics of the training session(s) time, date & location with the Owner.

#### 1.12 WARRANTY

- A. The system warranty shall be for twenty-four (24) months from the date of final acceptance. Provide all equipment, material, and labor required to uphold a full system warranty at no charge to the Owner. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of final acceptance. In the case of modified equipment, the manufacturer's warranty is normally voided. In such cases, provide the Owner with a warranty equivalent to that of the original manufacturer.
- B. There shall be no cost to the Owner for maintenance performed during the warranty period beyond the fixed cost of the contract.
- C. Provide a total of eight (8) one-day visits per year, or a total of sixty-four (64) engineering/ service labor hours to conduct preventive maintenance and the Owner directed system adjustments.
- D. Repair and/or adjust any malfunctioning components located by the technician during this testing. Include software and programming updates / modifications as part of this service contract, providing an updated editable copy of the source code to the Owner.
- E. Provide a service telephone number, staffed by a qualified technician familiar with the equipment installed. Staff this number during normal business hours.
- F. Respond with an on-site technician within 24-hours of a service call (including Saturdays and Sundays) for all equipment and system failures.
- G. Replace or repair, at no cost to the owner, any failed equipment hardware or software installations required to provide full system operations.
- H. During the warranty period, advise the Owner in writing each time any routine software and firmware updates become available, giving the Owner the opportunity to upgrade the software/hardware should they so desire at no additional cost. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.
- I. Provide updates to firmware during service period. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.
- J. The warranty period for any part which has a warranty by the manufacturer of longer than 24 months shall be for the longer period. Provide a copy of the manufacturer's warranty period statement for all major access control system components.

#### 1.13 SERVICE AND MAINTENANCE

- A. General Requirements: Provide all services required and equipment necessary to maintain the entire SMS in an operational state as specified for a period of two (2) year(s) after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled service or other unscheduled work.
- B. Description of Work: The service and repair of the SMS including all equipment provided under this specification supplied by the contractor. Provide the manufacturer's required scheduled and unscheduled maintenance and all other work necessary to keep the SMS at its maximum performance.

- C. Personnel: Service personnel shall be factory certified in the maintenance and repair of the equipment installed under this section of the specification. The owner shall be advised in writing of the name of the designated service representative, and of any change in personnel.
- D. Schedule of Work: This work shall be performed during regular working hours (8-5), Monday through Friday, excluding federal holidays.
  - 1. Inspections: The Contractor shall perform two minor inspections at 6 month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
  - 2. Minor Inspections: These inspections shall include:
    - a. Visual checks and operational tests of all console equipment, peripheral equipment, field hardware, sensors, and electrical and mechanical controls.
    - b. Mechanical adjustments if required on any mechanical or electromechanical devices
  - 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
    - a. Clean all SMS equipment, including interior and exterior surfaces.
    - b. Perform diagnostics on all equipment.
    - c. Check, walk test, and if required by the manufacturer's maintenance procedures, calibrate each sensor.
    - d. Run all system software diagnostics and correct all diagnosed problems.
- E. Operation: Performance of scheduled adjustments and repair shall verify operation of the SMS as demonstrated by the applicable tests of the performance verification test.
- F. Emergency Service: The owner will initiate service calls when the SMS is not functioning properly and hinders critical operation of the facility. Qualified personnel shall be available to provide service to the complete SMS repairs. The owner shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within four (4) hours after receiving a request for service. The SMS shall be restored to proper operating condition within eight (8) hours after service personnel arrive on site.
- G. Records and Logs: Keep records and logs of each task, and shall organize cumulative records for each component, and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial settings. Complete logs shall be kept and shall be available for inspection on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the SMS.
- H. Work Requests: Separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. Deliver a record of the work performed within 5 days after work is accomplished.
- I. System Modifications: Make any recommendations for system modification in writing to the Owner. No system modifications, shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.
- J. Software: Provide all software updates during the period of the warranty and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with SMS operators, shall include training for the new changes / features

enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.

#### 1.14 COMMISSIONING AND STARTUP

- A. Coordinate programming with owner to show all controllers, door interfaces, input and output panels are installed and configured to properly interface and function with existing systems per operational guidelines.
- B. Provide facility map as basis for door locations in software GUI.
- C. Contractor is not responsible for cardholder creation or badge production.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS AND MANUFACTURERS

- A. Equipment Lists: Refer to the following for materials and equipment required to complete the work of this Section.

#### 2.2 ELECTRONIC ACCESS CONTROL

- A. Manufacturers Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

- 1. LENEL S2

- B. Provide appropriate licensing to include added equipment in this section to the existing Lenel configuration/system.

#### 2.3 CONTROLLER

- A. Intelligent System Controller

- 1. Supports up to 64 modules – maximum 32 reader interface module
  - 2. Supports up to 500,000 cardholders in flash memory, with selective download for larger databases
  - 3. Elevator control up to 128 floors
  - 4. Up to 32,000 access level permissions
  - 5. RS-485 connection to remote door input/output modules
  - 6. Ethernet connection
  - 7. Provide enclosure and ancillary components required for complete working system.

- a. Product: Lenel LNL-X3300.

#### 2.4 INTERFACE MODULES

- A. Single Reader Interface Module

- 1. 12 or 24 VDC power supply
  - 2. Supports up to 16 different card formats
  - 3. Request to Exit monitoring

- a. Product: Lenel LNL-1300 Series 3.



B. Dual Reader Interface Module

1. 12 or 24 VDC power supply
2. Supports up to 16 different card formats
3. Request to Exit monitoring

a. Product: Lenel LNL-1320 Series 3.

C. Input and Output Control Module

1. Product LNL-1100 Series 3
2. Product: LNL-1200 Series 3

2.5 DEVICES

A. Card Readers

1. multiCLASS SE Reader

- a. 13.56 MHz Single Technology ID-1 Cards – SIO Model Data: iCLASS Seos: 0.8" (2 cm), iCLASS: 3.1" (8 cm), MIFARE Classic: 2.8" (7 cm), MIFARE DESFire EV1/EV2 1.2" (3 cm)
- b. 13.56 MHz Single Technology Tags/Fobs5 – SIO Data Model: iCLASS: 1.6" (4 cm), MIFARE Classic: 1.2" (3 cm)
- c. 125 kHz Single Technology ID-1 Cards: HID Prox: 2.8" (7 cm), Indala Prox: 1.6" (4 cm), EM4102 Prox: 4.3" (11 cm)
- d. 125 KHz Single Technology Tags/Fobs: HID Prox: 2.0" (5 cm), Indala Prox: 0.8" (2 cm), EM4102 Prox: 2.8" (7 cm)

2. Dimensions: 1.9" x 6.0" x 0.9" 4.8 cm x 15.3 cm x 2.3 cm
3. Ideally suited for mullion-mounted door installations or any flat surface

a. Product: hid - RP15

4. multiCLASS SE Reader

- a. 13.56 MHz Single Technology ID-1 Cards – SIO Model Data: iCLASS Seos: 1.2" (3 cm), iCLASS: 4.7" (12 cm), MIFARE Classic: 4.7" (12 cm), MIFARE DESFire EV1/EV2: 2.0" (5 cm)
- b. 13.56 MHz Single Technology Tags/Fobs5 – SIO Data Model: iCLASS: 2.4" (6 cm), MIFARE Classic: 2.0" (5 cm)
- c. 125 kHz Single Technology ID-1 Cards: HID Prox: 2.8" (7 cm), Indala Prox: 2.0" (5 cm), EM4102 Prox: 4.3" (11 cm)
- d. 125 KHz Single Technology Tags/Fobs: HID Prox: 2.0" (5 cm), Indala Prox: 1.2" (3 cm), EM4102 Prox: 2.8" (7 cm)

5. Dimensions: 3.3" x 4.8" x 1.0" 8.4 cm x 12.2 cm x 2.4 cm
6. Wall Switch Size; designed to mount and cover single gang switch boxes.
7. Indoor/Outdoor IP55; IP65 if installed with optional gasket (IP65GSKT) UL294/cUL (US), FCC Certification (US)

a. Product: hid: RP40

B. Steel Door Magnetic Contacts

1. Designed Specifically for Use in Steel Doors
2. Special Ribbed Sides Allow for Easy Installation
3. Housings shall be molded of flame retardant ABS plastic
4. Contact and magnet housing shall snap-lock into a 3/4" or 1" dia. Hole
5. Rugged Unibody Construction for Maximum Durability and Reliability
6. Terminal Models Available for Easier Installation
7. Regular, Wide Gap, SPDT, DPDT, and High Security Models Available
8. Rare Earth Magnet Designed for Steel Door w/Top Channel Available

a. Base manufacturer: Manufacturer used as the basis of design.

- 1) Interlogix 1078/1076 Series Steel Door contacts - <https://www.interlogix.com>

b. Alternate manufacturers: Manufacturers must meet all requirements listed in section 016000

- 1) Honeywell - [www.security.honeywellhome.com](http://www.security.honeywellhome.com)
- 2) Bosch – [www.commerce.boschsecurity.com](http://www.commerce.boschsecurity.com)

#### C. Panel Door Magnetic Contacts

1. Designed specifically for panel or sectional style overhead doors
2. Integrated mounting bracket Adjusts to fit most doors
3. Wide operating gap distance
4. All necessary mounting hardware included

a. Base manufacturer: Manufacturer used as the basis of design.

- 1) Interlogix 2300 Series Steel Door contacts - [www.interlogix.com](http://www.interlogix.com)

b. Alternate manufacturers: Manufacturers must meet all requirements listed in section 016000

- 1) Honeywell - [www.security.honeywellhome.com](http://www.security.honeywellhome.com)
- 2) Bosch – [www.commerce.boschsecurity.com](http://www.commerce.boschsecurity.com)

#### D. Access Control Bundle

1. SHLD 18awg-4/c (printed: lock power) plenum jacket
2. Larger gauge wire may be required to compensate for voltage drop over longer distances.
3. SHLD 22awg-3/PR (card reader) plenum jacket
4. SHLD 22awg-2/c (door contact) plenum jacket
5. SHLD 22awg-4/c (rex/ spare) plenum jacket
6. Door monitor cable - SHLD 22awg-2/c Plenum (door contact) plenum jacket.
7. Power cable – 16awg-2 conductor plenum jacket.
8. Lockout switch cable- 22 awg-2/c plenum jacket (lockout).

a. Product: Yellow Plenum overall jacket with components listed above

#### E. Power Supplies

1. Altronix Corp. Maxim series power supplies with fused output distribution (Altronix PD8UL) for both power supplies.

- a. Maxim11E
- b. Maxim13E
- c. Maxim33E
- d. Maxim35E
- e. Maxim37E
- f. Maxim55E
- g. Maxim75E

## 2.6 DATA/NETWORK

- A. One (1) assigned and static IP address accessible data port/connection shall be provided for each Controller Board installed.

## PART 3 - EXECUTION

### 3.1 GENERAL DESIGN STANDARDS

- A. Access control systems shall be designed and installed to not interfere with egress requirements for life safety nor interfere with intrusion or fire alarm systems.
- B. All access controlled handicap entrances shall be fully integrated into the building access control system ensuring that while providing access to the disabled, that proper access control is maintained in both the unsecured and secured modes. Access control systems shall be installed to comply with Americans with Disabilities Act and owner policies.
- C. All access control installations shall use housings and mountings which maintain or minimize disruption to architectural sensibilities or themes of the buildings and campus.
- D. All access control installations shall use housings and mounting designed to provide sufficient protection against tampering and vandalism. Torx center pin security fasteners shall be used on all devices installed in public areas.
- E. All equipment and components to support access control system shall be installed to manufacturer's specifications. Installation of components and hardware shall be in place prior to connection to the access control system.
- F. All access control systems shall be configured Fail Secure with mechanical manual egress from the secure side in the event of a loss of power, loss of network communications, or system failure.
- G. All access control equipped doors locking hardware shall include keyed locking mechanisms accessible from the unsecured side to allow keyed manual operation of the door.
- H. All access control equipped doors shall be keyed to a key system designated for access controlled doorways.
- I. All access control equipped doors shall be equipped with door position monitors and request to exit devices to allow for configuration of door condition alarms.
- J. All access controlled system equipment, including controllers and power supplies, shall be located in accessible and secure rooms as shown on contact drawings
- K. Electric power supplies and power converters for the access system equipment and hardware shall be installed in the room(s) housing the Access Control panels. Power supplies located at the access equipped door should be avoided.
- L. Electrical service to access control power supplies shall be on dedicated circuits.
- M. All access control equipment power supplies shall be equipped with battery back up to allow operation if electrical service and emergency generated power is lost.
- N. Provide conduit from all access devices, hardware, and equipment as shown on contract drawings.
- O. Wiring Connection Requirements: All low voltage control, monitor, power, and other cables shall be connected using sealed crimp type lugs, no wire nuts will be allowed.
- P. Monitor Contacts: Door monitoring contacts, and wiring and conduits there to, shall be concealed and invisible when the door is closed. Externally applied door monitoring

contacts, externally applied conduit or wire mold, and wire without conduit must be approved by Access Services, Project Manager, and building owner.

- Q. Request to Exit Switches: Request to exit (RX) switches should be mechanically hardware based devices. Passive infrared (PIR) or sonic detectors should only be used when no mechanical method is available.

### 3.2 CONDUCTORS, WIRE, CABLES

#### A. Data

1. All access control system data wiring, cables, jumpers, and connectors will comply with requirements of Section 27 01 00 Communication construction standards.

#### B. Low Voltage Electrical

1. All access control system low voltage electrical wiring, cables, and connectors will comply with the requirements of Section 27 01 00 Communication construction standards.
2. All access control system low voltage electrical wire shall be rated and adequate to supply the intended doors full functionality including but not limited to lock mechanisms, readers, and monitoring points without exceeding seventy-five percent (75%) of the wire's rated capacity
3. Distance from power supply to door lock should be examined to determine correct wire gauge to support expected voltage drop over distance.

### 3.3 CONTROLLERS

#### A. Intelligent System Controllers

1. All access control system controllers should be located in a secure location.
2. All access control system controllers and interface devices shall be housed in a metal case capable of being locked and monitored by the access control system for open/close position.

#### B. Wireless Controllers and Transceivers.

1. All access control system wireless transceivers / PIMs shall be mounted out of the public view in a secured room.
2. All access control system wireless transceivers/PIMs shall be housed in a metal case capable of being locked and monitored by the access control system for open/close position.
3. Avoid other equipment which might interfere with the proper operation of the controllers.

### 3.4 ELECTRICAL POWER NEEDS

1. Access control power cables shall not be installed to be within the public view. Any power cables within public view shall be placed in conduit to prevent damage or tampering.
2. All access control power supplies shall be rated and adequate to supply all controllers, door locks, card readers, and monitor devices without exceeding seventy-five percent (75%) of the power supply. In selection of power supply output, special attention should be paid to expected distance from power supply to door installation and resulting voltage drop over distance.
3. Access control power supplies should be equipped with battery back up to insure operation in the event of power failure.

4. Access control power supplies should be connected to the buildings emergency power system to insure service in the event of a power failure.
5. Access control power supplies shall be equipped to allow access system to detect and report building electrical power feed failure.
6. Access control power supplies shall provide a device or method to terminate building electrical power feed at the power supply by switch or plug.
7. A four gang electrical outlet connected to dedicated 20 amp power supply shall be provided at each controller/power supply installation location.

### 3.5 EQUIPMENT CABINETS

- A. All access control system controllers and power supplies shall be housed in metal cabinets capable of being locked using a key. The cabinet shall be secured to the wall. The final mounting location in the termination room(s) requires prior approval by the Owner.
- B. All access control system controller and power supplies cabinets shall be equipped with monitors to allow remote determination of cabinet cover door status (open vs closed).
- C. Conduit wire pathways shall be installed to house wiring passing from the power supply cabinets and the controller enclosures.

### 3.6 ELECTRONIC ACCESS CONTROL ADMINISTRATION

- A. Administration of the electronic access control infrastructure includes documentation of devices, cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, and telecommunications closets.
- B. In order to create a consistent environment, utilize an alphanumeric labeling system to label all access control cables and system components in a manner equivalent to the existing system labeling scheme.
  1. All cables and components used on electronic access control equipped doors and controllers shall be clearly marked using permanent means. Coordinate the preferred alphanumeric labeling system with the Owner.

### 3.7 RECORDS

- A. A record is a collection of information about or related to a specific element of the access control system. Records must be maintained in a computer printable spreadsheet, or in a computer database. A device and cable record is prepared for each device/door installation. The record will show the device/door name, and must describe the components from origin point and destination point. The device and cable record will record what services and/or connections are assigned to each installed location based on Equipped Door Number. An equipment record is prepared for services distributed from a certain piece of equipment, such as a controller, or a system.

### 3.8 DRAWINGS

- A. Drawings are used to illustrate different stages of access control system installation planning, installation, and administration.
- B. Installation or Construction Drawings
  1. Installation or construction drawings are the plans that show the installer how the infrastructure and devices are to be installed. The quality of the installation can be directly impacted by the level of detail in the installation drawings and written specifications. Installation drawings shall show, at a minimum, device installation, show pathway locations and routing, configuration of access control systems including door hardware installation, device installation, infrastructure, backboard

and equipment rack configurations, and wiring details include identifier assignments.

C. As-built Drawings

1. The as-built drawings graphically document the installed access control infrastructure through floor plan, elevation, and detail drawings. These drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure shall have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. As-built drawings must be kept current as adds, moves, and changes take place.

3.9 LABELING AND COLOR CODING

- A. It is important that both labeling and color coding be applied to all access control devices, wiring, and infrastructure components. Labeling with the unique identifier will identify a particular component. Proper color coding will quickly identify how that component is used in the overall systems infrastructure of the facility.

B. Labeling

1. Labels shall be applied to the wiring terminations and corresponding devices. Wiring and cable labels shall be applied at the doorway end and controller device side of cable and wiring runs.
2. Labels may be either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.
3. Outside plant labels shall be totally waterproof, even when submerged.
4. All labels shall be machine printed.
5. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.
6. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacturer.

END OF SECTION 271300

## SECTION 28 23 00 - VIDEO SURVEILLANCE SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Video Surveillance System.
  - 2. Cable connecting hardware, patch panels, and cross-connects.
  - 3. Cable management system.
  - 4. Cabling identification products.
  - 5. Grounding.
  - 6. Pathways.
- B. Related Sections
  - 1. 271000 – Telecommunications Structured Cabling
  - 2. 281300 – Electronic Access Control
- C. System Requirements
  - 1. Install video surveillance cameras, hardware, head-end equipment, video recorders, power supplies, lightning protection, fiber transceivers, server/client software, licenses, related security hardware as specified and as detailed in associated contract drawings.
  - 2. Integrate system hardware, software, licenses, and locations to provide a full functioning and complete video surveillance system.

#### 1.2 REFERENCES

- A. The Codes and Regulations listed below form a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:
  - 1. UL 294, UL 1076, ULC
  - 2. CE
  - 3. FCC – Part 15, Part 68
  - 4. NFPA 70, NEC
  - 5. IEEE, RS 170 variable standard
  - 6. RoHS
- B. Where more than one code or regulation is applicable, the more stringent shall apply.
- C. Cable and equipment installation, identification and termination shall be performed in accordance to the applicable codes above.

#### 1.3 DEFINITIONS

- A. ADA: Americans with Disabilities Act
- B. Bid: Herein, used interchangeably with “proposal”
- C. Demarc: “Demarcation Point” marking the location where communications facilities owned by one organization interface with that of another.
- D. DVR: Digital Video Recorder
- E. GUI: Graphical User Interface
- F. LAN: Local Area Network
- G. IP: Internet Protocol
- H. IR: Infrared

- I. NIC: material and work which is Not In Contract and for which the Installer is not responsible except as otherwise detailed herein.
- J. NVR: Network Video Recorder
- K. OFE: "Owner Furnished Equipment" which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.
- L. OFCI: "Owner Furnished Contractor Installed" Equipment which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.
- M. OSP: Outside Service Plant
- N. PoE: Power over Ethernet
- O. TR: Telecommunications Room
- P. UPS: Uninterruptable Power Supply
- Q. The term "shall" is mandatory.
- R. The term "will" is informative.
- S. The term "should" is advisory.
- T. Term "provide" means furnish and install.
- U. Security Consultant: Convergent Technologies Design Group, Inc.
- V. SMS: Security Management System
- W. Bidder: Qualified firm intending to tender a bid on the systems described herein.
- X. Construction Manager (CM) or General Contractor (GC): The representative responsible for general building construction and onsite coordination between sub-contractors

#### 1.4 BID PROPOSALS

- A. Itemized Bid Response
  - 1. Each piece of equipment shall be individually priced and submitted with Bid Proposals. Provide itemized bid response to include equipment description, manufacturer, model number, unit price, and quantity. All equipment prices shall reflect required modifications and accessories as needed for a complete and functioning system.
  - 2. Non-equipment charges shall be outlined separately as a single line item. A sum of the video surveillance system total cost shall be provided with the bid proposal.
  - 3. Lump sum bids will not be accepted.
- B. Contractor Qualification
  - 1. Demonstrate at least three (3) years experience in the fabrication, programming, assembly, and installation of video surveillance systems of similar magnitude and quality as specified for the subject job. Submit documentation to this effect with the bid response. Be an authorized sales and service center for all listed components and offerings in this specification.
  - 2. References: Furnish no less than three (3) references for installations of similar size (dollar amount & quantity of spaces receiving surveillance systems) and scope, performed throughout the project area within the past three (3) years. At a minimum, reference information will include the reference company or institute name, contact person's name and title, telephone number, address, and detailed project description, project manager's name, and contact information of the organization that is responsible for day-to-day operation of the video surveillance system installation.
  - 3. Bidders shall include as part of the bid response the following items:
    - a. List of all technical personnel factory-certified on specified products.



- b. Letter of approval from the manufacturer indicating compliance with qualification requirements.
  - c. Installation schedule with proposed manpower assignments.
  - d. Resumes for project manager, lead engineer and all ASIS certifications for this project.
  - e. Training certificates for design, engineering and installation of the proposed products shall be submitted with the proposal.
  - f. Service Dispatch outline containing the type of service program used for dispatching and tracking service calls.
- C. Alternate Proposals
  - 1. Any proposed alternate equipment choices should be requested in writing prior to the proposal submission for approval. Each item on the alternate equipment list must be accompanied by catalog cut sheets and technical specifications.
- D. Non-Equipment Charges, Including but not be limited to:
  - 1. Engineering: Including all required design drawings, run sheets, instruction manuals, console layout, step-by-step user guide, etc.
  - 2. Pre-Installation: Work performed on the Installer's premises including all fabrication, modification, assembly, rack wiring, etc.
  - 3. Installation: Including all on-site installation and wiring, shop drawing, coordination and supervision, testing, checkout, Owner training, etc., performed on the Owner's premises.
  - 4. General and Administrative: Including all shipping, insurance, and guarantees.
- E. Owner Furnished Equipment (OFE, OFCI)
  - 1. Identify any Owner Furnished Equipment assumed in the Bid Proposal to be installed and integrated under this contract. Identify all assumed Owner Furnished equipment within each room/space type that will be required to complete the video surveillance systems installation.
- F. State of the Art Development
  - 1. Supply only the manufacturer's latest developed product. In cases where product development surpasses the criteria of the specification, inform the Architect and make the newer product available to the project at no additional cost. In no case shall discontinued or obsolete equipment be acceptable. The same requirement applies to software programs developed/updated during the warranty period.
  - 2. Should a manufacturer discontinue a specified product, provide the manufacturer's recommended replacement at no additional cost to the owner. Should the manufacturer have no direct replacement product, propose a product of equal or greater specification from an alternate manufacturer at no additional cost to the owner.
  - 3. Should a product recall by a specified manufacturer require temporary or permanent replacement of a product specified under this section, notify the Architect at the earliest possible time and arrange to replace the product in question as quickly as possible.
    - a. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
    - b. Equipment defect or intended recall shall not relieve the video surveillance contractor from any contractual obligations with regard to delivery schedule of product.
    - c. Under no circumstances shall arrangement for alternate product require the Owner to accept superseded equipment except on a temporary basis.
- G. Service Contract
  - 1. Submit the costs for a one-year service contract, renewable for up to three years, which shall commence with the completion of the two-year warranty period. These contracts shall be fixed-cost and can be accepted at the option of the Owner.

2. The service contract shall include all of the services provided during the warranty period, including complete replacement or repair of defective equipment.

## 1.5 QUALITY ASSURANCE

- A. Coordination
  1. 281300 for integration requirements of Access Control system components.
  2. 271000 for pathways, cabling locations, colors, termination ports, and all OSP locations related to video surveillance systems.
  3. Test and verify structured cabling installed to support the video surveillance system.
  4. Coordinate layout and installation of Video Surveillance Systems equipment with Owner's security representative.
    - a. Meet jointly with Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
    - b. Record agreements reached in meetings and distribute them to other participants and the project Architect for design team distribution.
  5. Coordinate this Section with work of other Project Manual sections and associated trades.
  6. Specific references, herein, requiring coordination of certain work shall not obviate responsibility for other required coordination.
- B. Unspecified Equipment and Material
  1. All equipment and materials not specifically addressed on the drawings or in this document and required to provide complete and functional video surveillance system shall be provided in a level of quality consistent with other specified items.
- C. Standards and Codes
  1. Comply with
    - a. Local, state and federal codes
    - b. Applicable National Electrical Code
    - c. American National Standards Institute
    - d. Underwriters' Laboratories, Inc. standards.
  2. All equipment, material, accessories, and loose items provided by Contractor shall be new and shall conform to applicable requirements of the above-mentioned agencies.
  3. If required by local authorities, provide certificates and labels indicating compliance with above-mentioned codes and standards where applicable.
- D. Point of Contact
  1. Designate to the Owner in writing, the responsible person who shall ensure timely and consistent communication with the Owner on progress of the contract. The designated representative shall have full knowledge of all engineering and production procedures and shall report status of the installation and upcoming work plans to the Owner's Project Manager and Consultant on a weekly basis.
  2. Project manager shall have successfully managed not less than two (2) projects of similar size and scope (as defined in previous sections). Bid submission shall detail the percentage of time that the project manager and other key personnel will be involved with the project.

## 1.6 SCOPE OF WORK

- A. Provide the following in accordance with Specifications and Drawings
  1. Submittals delivered in a timely manner as described hereinafter.
  2. Verification of dimensions and other conditions at project site. Review conduit system as shown in electrical section of building construction documents and, where applicable, as built conditions. Notify Consultant, Architect, GC, and EC within four weeks after award of contract of any deficiencies or inadequacies in conduit system design.
  3. Detailed design of video surveillance system GUI, system "maps," including remote-control accommodations.

4. Power distribution and battery backup within equipment racks including power connection to electrical outlets as described in electrical section of building construction documents.
  5. Incidentals necessary for a complete working system.
  6. Initial testing and adjustments, demonstration of system for approval, participation in acceptance tests, final adjustments as required.
  7. Record Documents, "As-Built" drawings and Owners Manual.
  8. Training of operating personnel.
  9. Notify appropriate parties of conflicts in a timely manner.
  10. Work cooperatively with other trades to resolve conflicts.
- B. Special Insurance
1. Provide insurance fully covering all equipment against loss, damage, and theft during shipment, storage, installation, testing, adjustment and demonstration.

## 1.7 SYSTEM DESCRIPTION

- A. All building and room video surveillance systems shall be systems, equipment, and accessories compatible with the current Avigilon video surveillance system. All auxiliary accessories or supporting devices shall be fully compatible with and able to integrate with existing campus system.
- B. Video cameras shall be positioned at strategic locations throughout the facility and at the facility perimeter to meet with owner standards. TCP/IP video signals shall be routed through the building network to a central network recording device. A video management server will allow video surveillance monitoring at primary locations, as well as at authorized workstations. Remote control over camera selection for monitoring purposes will be available at video monitoring locations. Integration with the building Intrusion Detection System is required to enable automated recording of unauthorized motion events.
- C. The SMS shall be able to seamlessly interface with and monitor intelligent system controllers, reader interface modules, I/O panels, burglar alarm panels, burglar alarm panel receivers, biometric devices, personal protection devices, intercom systems, fire alarm panels (secondary monitoring only), building management systems and digital/network video recorders and software.
- D. Design Intent
1. Provide a complete and functioning video surveillance system inclusive of all hardware, software and training to meet or exceed the performance features outlined in this document.

## 1.8 SUBMITTALS

- A. Related Sections
1. Comply with requirements of Section 01 33 00 - Submittal Procedures.
- B. Submittal Data
1. Submittal data is to be submitted in a three ring binder, a continuous spiral binder, or plastic binding that allows the booklet to lie flat while open. Each booklet shall contain the below in the following order:
  2. Cover Sheet.
    - a. Include name of supplying contractor and project name.
  3. Detailed Bill of Materials.
    - a. Include a listing of: component quantities, equipment manufacturers, model numbers, and description of each component being supplied, and the specification paragraph or drawing sheet that corresponds to the product. Failure to provide this information will result in the rejection of submittals.
  4. Product Data.
    - a. Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet

shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product. Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures. If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight.

5. Authorized Distributor Certificate.

- a. Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.

C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. Shop Drawings are to be submitted on project standard full size and bound. Each shop drawing set is to include the below in the following order:
  - a. Title Sheet & Symbols Legend
  - b. Riser Diagram: Provide riser diagrams of the video surveillance systems and any other systems specified herein.
  - c. Block Diagrams: Submit block diagrams for each system indicating connections of equipment and indicating equipment types and model numbers.
  - d. Coordination Drawings: Elevation Details of wall fields in Telecommunications Rooms showing the relationship of rack mounted elements inclusive of Owner provided equipment (labeled as such).
  - e. All unusual equipment modifications.
  - f. Front mechanical drawings of each equipment rack.
  - g. Equipment location drawings.
  - h. Cable labeling plan.
  - i. Floor Plans, RCPs and Elevations: Show planned location for all elements and cable routing. Drawings shall be at project standard scale and clearly legible.

D. Form

1. Submit all materials for review as described above, specifically referenced to the Specification paragraph number (where applicable).
  - a. Submit all drawings on sheets of one size, preferably the project standard size.
  - b. Where materials are presented on sheets 11" x 17" or smaller, organize into three-ring binder which include:
    - 1) Dividers or tabs between logical sections
    - 2) Project name and binder title labels on face and edge of binders
  - c. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.
2. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following Submittals shall not be considered partial:
  - a. Personnel
  - b. Milestones
  - c. Conduit Verification Statement and Notifications
  - d. Rigging and Mounting Drawings
  - e. As-Built Documentation
3. Product Data and Shop drawings must be submitted together in order to be reviewed.

E. Weekly Reporting

1. Commencing with project award, provide weekly status reporting of milestone task status, anticipated completion date, and related memo notes for the following tasks:
  - a. Submittals
  - b. Infrastructure verification
  - c. Pre-wire status
  - d. Equipment Procurement
  - e. Shop fabrication

- f. Remote control system design
  - g. Installation and Terminations
  - h. Field testing and pre-acceptance testing
  - i. Final acceptance demonstrations
  - j. Owner training
  - k. First owner use
  - l. Open Coordination Items and Questions
2. See below for a partial example of an acceptable weekly reporting list.

Project: <i>Project Name</i>							
Location: <i>Project Location</i>				Date: <i>Form Delivery Date</i>			
Project Manager: <i>Project Manager</i>				Delivered by: <i>Form Delivered By</i>			
		Projected Completion:		Status:		Notes:	
Infrastructure Verification:		<i>6/1/2011</i>		<i>Complete</i>			
Submittals:							
	<i>Product Data</i>	<i>8/1/2011</i>	<i>Complete</i>				
	<i>Drawings</i>	<i>8/1/2011</i>	<i>Complete</i>				
	<i>Personnel (etc.)</i>	<i>8/1/2011</i>	<i>Complete</i>				
RFIs:							
	<i>12</i>	<i>8/25/2011</i>	<i>Received</i>		<i>Implementing</i>		
	<i>178</i>	<i>9/6/2011</i>	<i>Pending</i>		<i>Projector Screen Clearances</i>		
Installation Status by Space							
Room		Equipment					
Name	Number	Pre-Wire	Order	Receive	Install	Test	Notes:
<i>Example 1</i>	<i>105</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>60%</i>	<i>0%</i>	<i>Re-programming</i>
<i>Example 2</i>	<i>135</i>	<i>100%</i>	<i>100%</i>	<i>100%</i>	<i>90%</i>	<i>0%</i>	<i>Other Notes Here</i>

#### F. Personnel

1. Provide, in writing, within two weeks after award of Contract, the names, mailing address, phone numbers with extensions, email addresses and paging service numbers (if available) of the following project personnel:
  - a. Project Manager
  - b. Lead Systems Engineer
  - c. Field Foreman
2. Within four weeks after award of Contract, submit statement confirming that Contractor has reviewed the conduit system as designed in building construction documents and, where applicable, as built.
3. Notify Consultant, General Contractor, Architect or Electrical Contractor of deficiencies or inadequacies, if any, in conduit system design or installation. If none, so indicate.
4. Absent conduit verification by Contractor and after installation of conduit as designed, Contractor shall assume costs of equipment, materials, labor and engineering, including services of owner's representative(s) in designing and/or verifying revised wiring approach(es) as relate to providing a fully functional system using conduit as designed or as revised at the discretion of the owner.

#### 1.9 CLOSEOUT SUBMITTALS

- A. At the completion of the installation, but before Final Acceptance, provide for review and approval the following, in compliance with Division 1 Section *Closeout Procedures*.
  1. Operation and Maintenance Manuals:
    - a. Equipment manufacturer's operation and service manuals for each make and model of equipment.
    - b. System Operation Manual. Produce a manual specifically for the subsystems detailed herein. The manual shall describe all procedures necessary to activate each system to provide for the functional requirements, except as specifically excluded by the Owner. This section shall provide a simple "How-to" users guide for the procedures needed to operate the system. This document shall contain a section on operating the systems equipment in the event of control system failure. Control system touch panel layouts shall be accompanied by narrative text describing "step-by-step" function engagement.
- B. Warranty
  1. Provide list and dates of activation of equipment warranties
  2. Provide original manufacturers' certificates.
- C. As-built Drawings
  1. Include contractor generated (mark-up of contract documents is not acceptable) digital record diagrams for all systems including, but not limited to:
    - a. Schematic wiring diagrams with cable markings.
    - b. Internal wiring diagrams of the equipment rack and enclosures.
    - c. Custom equipment modifications.
    - d. Final test results and nominal settings for all adjustable controls.
- D. Software Passwords
  1. Software Passwords Schedule (i.e., a spreadsheet listing the manufacturer, model number and location in the Facility, of each piece of video surveillance equipment, the software for which is password-protected).
  2. Provide to Owner's Representative as a secure document separate from Operating and Maintenance Manuals and As-Built Drawings.
- E. Laminated Instruction Cards
  1. Provide 8 ½ x 11 Instruction cards, approved by the Owner. Laminate step-by-step instructions outlining system operations for the video surveillance system. Provide editable file of card to Owner.

#### 1.10 DELIVERY, STORAGE, HANDLING, AND STAGING

- A. Supply, transport, deliver, unload, move to the installation location, unpack, place, assemble, secure, connect, and install all equipment needed to complete the installation. Be responsible for transportation, parking, delivery, and on-site storage of the system's equipment. Be responsible for all transportation of personnel to and from the site.
- B. Reconfirm before delivery that hallways, stairways, passages, doorways, rooms, entries, elevators and foyers are of sufficient size to accommodate the passage and installation of the equipment and systems. Off-site pre-staging of goods is encouraged.
- C. The Owner's acknowledgment of delivery of goods and any payment made on account of such delivery shall not constitute acceptance (partial or otherwise) and shall not diminish obligations as specified.
- D. The actual dates of delivery shall be under the absolute control of the Owner. The dates and times for delivery/installation are critical to the successful completion of the project. Deliveries shall normally be accepted only Monday through Friday 8:00 a.m. to 4:00 p.m. In the event it becomes necessary for goods to be installed outside these hours comply with the instructions of the Owner. Deliveries attempted outside these hours without prior consent of the Owner may be turned away. Comply with all instructions of the Owner and the Contractor concerning time of arrival at the site; which entrance shall be utilized

for delivery; routes to be taken to reach the installation location; and other matters relating to the orderly and timely installation of the system.

- E. Installation shall commence immediately upon delivery of materials to the jobsite, except as directed by Construction Manager. Time required from delivery date to completion of project shall be in accordance with the approved schedules.
- F. Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- G. Do not deliver or install equipment until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and work above ceilings is complete.

#### 1.11 SYSTEM TRAINING

- A. Training: Provide training in the operation and maintenance of the system for personnel designated by the Owner. Record owner training sessions on DVD or other agreed upon media, and make training videos available to the owner at no charge. The training shall be organized as follows:
  - 1. Two (2) two-hour training classes for system technical operation and maintenance. This class shall cover the following topics:
    - a. Review of signal flow diagrams.
    - b. Review of all equipment functions, relevant to the function in this system.
    - c. Review of initial equipment settings.
    - d. Demonstration of all functional connections from a user perspective.
    - e. Review & demonstration of control system software replacement/upgrade procedures.
    - f. Review of manufacturers' recommended routine maintenance procedures.
  - 2. Four (4) days of advanced user training for systems operations. This shall include day-to-day operation as well as in-depth review of system capabilities and programming.
  - 3. Training may take place at any time (chosen by the Owner) after the systems are operational, up to a year following system acceptance.
  - 4. Close out submittals shall be provided prior to any training classes.
  - 5. Coordinate detailed specifics of the training session(s) time, date & location with the Owner.

#### 1.12 WARRANTY

- A. The system warranty shall be for twenty-four (24) months from the date of final acceptance. Provide all equipment, material, and labor required to uphold a full system warranty at no charge to the Owner. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of final acceptance. In the case of modified equipment, the manufacturer's warranty is normally voided. In such cases, provide the Owner with a warranty equivalent to that of the original manufacturer.
- B. There shall be no cost to the Owner for maintenance performed during the warranty period beyond the fixed cost of the contract.
- C. Provide a total of eight (8) one-day visits per year, or a total of sixty-four (64) engineering/service labor hours to conduct preventive maintenance and the Owner directed system adjustments.
- D. Repair and/or adjust any malfunctioning components located by the technician during this testing. Include software and programming updates / modifications as part of this service contract, providing an updated editable copy of the source code to the Owner.
- E. Provide a service telephone number, staffed by a qualified technician familiar with the equipment installed. Staff this number during normal business hours.

- F. Respond with an on-site technician within 24-hours of a service call (including Saturdays and Sundays) for all equipment and system failures.
- G. Replace or repair, at no cost to the owner, any failed equipment hardware or software installations required to provide full system operations.
- H. During the warranty period, advise the Owner in writing each time any routine software and firmware updates become available, giving the Owner the opportunity to upgrade the software/hardware should they so desire at no additional cost. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.
- I. Provide updates to firmware during service period. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.
- J. The warranty period for any part which has a warranty by the manufacturer of longer than 24 months shall be for the longer period. Provide a copy of the manufacturer's warranty period statement for all major video surveillance system components.

#### 1.13 SERVICE AND MAINTENANCE

- A. General Requirements: Provide all services required and equipment necessary to maintain the entire SMS in an operational state as specified for a period of two (2) year(s) after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled service or other unscheduled work.
- B. Description of Work: The service and repair of the SMS including all equipment provided under this specification supplied by the contractor. Provide the manufacturer's required scheduled and unscheduled maintenance and all other work necessary to keep the SMS at its maximum performance.
- C. Personnel: Service personnel shall be factory certified in the maintenance and repair of the equipment installed under this section of the specification. The owner shall be advised in writing of the name of the designated service representative, and of any change in personnel.
- D. Schedule of Work: This work shall be performed during regular working hours (8-5), Monday through Friday, excluding federal holidays.
  - 1. Inspections: The Contractor shall perform two minor inspections at 6 month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
  - 2. Minor Inspections: These inspections shall include:
    - a. Visual checks and operational tests of all console equipment, peripheral equipment, field hardware, sensors, and electrical and mechanical controls.
    - b. Mechanical adjustments if required on any mechanical or electromechanical devices
  - 3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
    - a. Clean all SMS equipment, including interior and exterior surfaces.
    - b. Perform diagnostics on all equipment.
    - c. Check, walk test, and if required by the manufacturer's maintenance procedures, calibrate each sensor.
    - d. Run all system software diagnostics and correct all diagnosed problems.
- E. Operation: Performance of scheduled adjustments and repair shall verify operation of the SMS as demonstrated by the applicable tests of the performance verification test.
- F. Emergency Service: The owner will initiate service calls when the SMS is not functioning properly and hinders critical operation of the facility. Qualified personnel shall be available to provide service to the complete SMS repairs. The owner shall be furnished with a



telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within four (4) hours after receiving a request for service. The SMS shall be restored to proper operating condition within eight (8) hours after service personnel arrive on site.

- G. Work Requests: Separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. Deliver a record of the work performed within 5 days after work is accomplished.
- H. System Modifications: Make any recommendations for system modification in writing to the Owner. No system modifications, shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.
- I. Software: Provide all software updates during the period of the warranty and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with SMS operators, shall include training for the new changes / features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.

#### 1.14 COMMISSIONING AND STARTUP

- A. Coordinate programming with owner to show all controllers, door interfaces, input and output panels are installed and configured to properly interface and function with existing university systems per operational guidelines.
- B. Provide facility map as basis for door locations in software GUI.
- C. Contractor is not responsible for cardholder creation or badge production.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS AND MANUFACTURERS

- A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
  - 1. Basis of Design Manufacturer: Avigilon.
- B. Equipment Lists: Refer to the following for materials and equipment required to complete the work of this Section.
- C. Provide appropriate licensing to include added equipment in this section to the existing configuration/system.

#### 2.2 DATA/NETWORK

- A. Data transmission cable.
  - 1. All video surveillance system data wiring, cables, jumpers, and connectors per Section 27 10 00 Communication construction standards.
- B. Low voltage electrical wiring.
  - 1. All video surveillance system low voltage electrical wiring, cables, and connectors will comply with the requirements of Section 27 10 00 Communication construction standards.
  - 2. All video surveillance system low voltage electrical wire shall be rated and adequate to supply the intended cameras full functionality including but not limited to camera

operations, audio equipment, mechanical movement, and environmental housing without exceeding seventy-five percent (75%) of the wire's rated capacity.

### 2.3 NETWORK VIDEO RECORDER

- A. Throughput: NVR system must be capable of managing a combined 1800 Mbps of total throughput with handling for simultaneous recording, playback and live streaming.
- B. Search Capacity: System must be capable of supporting up to one hundred (100) cameras.
- C. Storage Capacity: System must be capable of storing up to 180TB raw or 157TB when configured as RAID 6.
- D. Expansion: System must be configured to be capable of future expansion and scaling.
- E. Mounting: Standard server enclosure (rack) mounting, requiring no greater than a 2U configuration.
- F. Electrical Power:
  - 1. Input: 100 to 240 V AC, 50/60 Hz, auto-switching.
  - 2. Supply: Appliance must be configurable for multiple power supplies that may be replaced without the need to power down (hot-swappable).
  - 3. Maximum Power Consumption: No greater than 2200W.

#### G. NETWORK VIDEO RECORDERS

- 1. Basis of Design Product: Avigilon HD NVR4 Premium.
  - a. System Design:
    - 1) Drive Configuration:
      - a) Video Storage: Up to 18 x large form factor near-line SAS hard disk drives, hot-swappable, RAID 6.
      - b) Operating System: (2) M.2 SSD drives, RAID 1.
    - 2) Storage Capacity: 64 TB when configured with RAID 6.
    - 3) Storage Capacity: 96 TB when configured with RAID 6.
    - 4) Storage Capacity: 128 TB when configured with RAID 6.
    - 5) Storage Capacity: 157 TB when configured with RAID 6.
    - 6) Operating System: Microsoft Windows Server 2016.
    - 7) Processor: Intel Xeon.
    - 8) RAM: 32GB DDR4.
    - 9) Networking: (2) 10GB Ethernet SFP+ ports and (2) 1GB Ethernet RJ-45 ports (1000Base-T).
    - 10) Power Supply: (2) 80 plus Titanium power supplies configured to allow swapping without the need to power down.
    - 11) Video Output: VGA.
    - 12) Mounting: 2U rack mount chassis.
    - 13) Operational Range:
      - a) Temperature: 10 degrees C to 35 degrees C [50F to 95F].
      - b) Relative Humidity: 10–80 percent (non-condensing).
      - c) Altitude: 3048 meters [10,000 ft].

### 2.4 SERVER LICENCES AND SOFTWARE

#### A. NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS)

- 1. Description: Provide workstations with a simplified screen layout, intuitive controls, and customizable features that improve multi-person interactions, and include the following features:
  - a. Video analytics and artificial intelligence (AI) capabilities, including appearance search, analytic event rule triggers, and unusual motion detection technology.
  - b. Forensic search capabilities with bookmark, event, alarm and thumbnail search options.
  - c. Easy integration with leading camera and hardware manufacturers.

- d. Allows monitoring of live and recorded video over wireless IP networks from Apple or Android mobile devices.
  - e. License Plate Recognition (LPR) analytics with multiple watchlists.
- 2. System: Provide a scalable NVMS solution with the following capabilities:
  - a. 100 servers per site.
  - b. 300 cameras per server.
  - c. 10,000 cameras per site.
  - d. Unlimited client licenses.
- 3. Basis of Design Product: Subject to compliance with requirements, provide Avigilon Control Center Enterprise - Version 7.0 by Avigilon

## 2.5 CAMERAS

- A. 4.0 MP Indoor In-Ceiling Mount Camera with 3.3 - 9 mm lens.
  - 1. Basis of Design Product: 4.0C-H5A-DC1, by Avigilon.
  - 2. Performance:
  - 3. Image Sensor: 1/2.8 inch progressive scan CMOS.
  - 4. Maximum Resolution:
    - a. Aspect Ratio: 16:9: 2560 x 1440.
    - b. Aspect Ratio: 4:3: 2304 x 1728.
  - 5. Imaging Rate:
    - a. WDR Off: (50 Hz/60 Hz): 25 fps/30 fps.
    - b. WDR On: (50 Hz/60 Hz): 20 fps/20 fps.
  - 6. Dynamic Range:
    - a. WDR Off: 83 dB.
    - b. WDR On: 126 dB.
  - 7. Minimum Illumination:
    - a. Color: 0.030 lux.
    - b. Monochrome: 0.015 lux.
  - 8. Field of View:
  - 9. Horizontal angle: 16:9: 34 degrees to 92 degrees.
    - a. Horizontal angle: 4:3: 34 degrees to 92 degrees.
    - b. Vertical angle: 16:9: 18 degrees to 50 degrees
    - c. Vertical angle: 4:3: 25 degrees to 68 degrees
- B. 4.0 MP Outdoor Dome-Type Camera with 3.3 - 9 mm lens.
  - 1. Basis of Design Product: 4.0C-H5A-DO1, by Avigilon.
  - 2. Performance:
  - 3. Image Sensor: 1/2.8 inch progressive scan CMOS.
  - 4. Maximum Resolution:
    - a. Aspect Ratio: 16:9: 2560 x 1440.
    - b. Aspect Ratio: 4:3: 2304 x 1728.
  - 5. Imaging Rate:
    - a. WDR Off: (50 Hz/60 Hz): 25 fps/30 fps.
    - b. WDR On: (50 Hz/60 Hz): 20 fps/20 fps.
  - 6. Dynamic Range:
    - a. WDR Off: 83 dB.
    - b. WDR On: 126 dB.
  - 7. Minimum Illumination:
    - a. Color: 0.030 lux.
    - b. Monochrome: 0.015 lux.
  - 8. Field of View:
    - a. Horizontal angle: 16:9: 34 degrees to 92 degrees.
    - b. Horizontal angle: 4:3: 34 degrees to 92 degrees.
    - c. Vertical angle: 16:9: 18 degrees to 50 degrees
    - d. Vertical angle: 4:3: 25 degrees to 68 degrees

## 2.6 ELECTRICAL POWER NEEDS

- A. Video surveillance cameras shall be powered via PoE.
- B. Provide Lightning Protection Module at all exterior camera locations. Basis of design shall be Ditek model DTK-MJRPOE.
- C. Video surveillance system power cables shall not be installed to be within the public view. Any power cables within public view shall be placed in conduit to prevent damage or tampering.
- D. Remote Exterior cameras requiring optical fiber runs shall be powered by AC. Refer to TA series drawings for requirements.

## 2.7 MOUNTING EQUIPMENT

- A. All video surveillance cameras housings and mounts adequate to provide protection against accidental and intentional damage or tampering. Torx center pin security fasteners shall be used on devices in public areas.
- B. All video surveillance camera housings and mounts shall have adequate housings and environmental controls to insure proper operation of camera as determined by environmental conditions and building usage.

## 2.8 DATA TRANSMISSION RESOURCES NEEDS

- A. Data cable runs shall be limit to no more than 290 ft from the camera device and switch. During design and installation close attention must be paid to the distance of cabling runs for video surveillance.
- B. Camera installations at remote exterior locations shall use optical fiber with UTP/optical fiber transceivers to transmit video signals to the telecom room. Remote hardened switches may be used as an alternate configuration.
- C. All data transmissions between cameras and recording servers or devices shall be encrypted or made on secure network pathways to ensure data cannot be intercepted or manipulated.

# PART 3 - EXECUTION

## 3.1 GENERAL DESIGN STANDARDS

- A. Video surveillance systems shall be designed and installed to not interfere with egress requirements for life safety nor interfere with intrusion or fire alarm systems.
- B. All video surveillance installations shall using housings and mountings which maintain or minimize disruption to architectural sensibilities or themes of the buildings and campus.
- C. All video surveillance installations shall using housings and mounting designed to provide sufficient protection against tampering and vandalism. Torx center pin security fasteners shall be used on all devices installed in public areas.
- D. All equipment and components to support video surveillance system shall be installed to manufacturer's specifications. Installation of components and hardware shall be in place prior to connection to the video surveillance system.
- E. All video surveillance system equipment, including controllers and power supplies, shall be located in accessible and secure rooms; with Telecommunication/ IDF rooms being preferred.
- F. Electrical service to video surveillance power supplies shall be on dedicated circuits. Where practicable, electric power for the access system should be provided through the building emergency power supply.
- G. All video surveillance equipment power supplies shall be equipped with battery back up to allow operation if electrical service and emergency generated power is lost.

- H. Wiring Connection Requirements: All low voltage control, monitor, power, and other cables shall be connected using sealed crimp type lugs, no wire nuts will be allowed.

### 3.2 CONDUCTORS, WIRE, CABLES

#### A. Data

1. All video surveillance system data wiring, cables, jumpers, and connectors will comply with requirements of Section 27 01 00 Communication construction standards.

#### B. Low Voltage Electrical

1. All video surveillance system low voltage electrical wiring, cables, and connectors will comply with the requirements of Section 27 01 00 Communication construction standards.
2. All video surveillance system low voltage electrical wire shall be rated and adequate to supply the intended doors full functionality including but not limited to lock mechanisms, readers, and monitoring points without exceeding seventy-five percent (75%) of the wire's rated capacity
3. Distance from power supply to door lock should be examined to determine correct wire gauge to support expected voltage drop over distance.

### 3.3 VIDEO SURVEILLANCE ADMINISTRATION

- A. Administration of the video surveillance infrastructure includes documentation of devices, cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, and telecommunications closets. All UMMS facilities apply and maintain a system for documenting and administering the video surveillance infrastructure.

- B. All video surveillance cameras, devices, and cables shall be clearly marked using permanent means. Video cameras shall use the following system of numbering

1. Exterior Cameras Mounted Viewing Building Entrance: Abbreviated building name + EXT + number of door + abbreviated compass direction of door relative to the center of the building. Example DBPS EXT 27 NW (if more than one camera at entrance for the same purpose include decimal designator to number of door).
2. Exterior Camera Mounted to Building Viewing Parking Lot: Abbreviated building name + LOT + number of parking lot + abbreviated compass direction of door relative to the center of the parking lot. Example DBPS LOT R10 S.
3. Exterior Camera Mounted to Building Viewing Area Around Building: Abbreviated building name + EXT + abbreviated name of area covered + abbreviated compass direction of area viewed relative to the center of the area viewed. Example DBPS EXT 27 NW (if more than one camera at entrance for the same purpose include decimal designator to name of area covered).
4. Exterior Camera Mounted Light Pole Viewing Area: Abbreviated name of area viewed + EXT + abbreviated building name of nearest building + abbreviated compass direction of area viewed relative to the center of the area viewed. Examples EXT JCK E.
5. Exterior Camera Mounted to Light Pole Viewing Parking Lot: LOT + number of parking lot + abbreviated compass direction of area viewed relative to the center of the parking lot. Example LOT R5 SW.
6. Interior Camera Mounted Viewing Building Entrance: Abbreviated building name + INT + Floor + number of door + abbreviated compass direction of door relative to the center of the building. Example DBPS INT 1st 27 NW (if more than one camera at entrance for the same purpose include decimal designator).
7. Interior Camera Mounted Viewing Interior Room: Abbreviated building name + INT + number of room. Example DBPS INT 202 (if more than one camera at entrance for the same purpose include a decimal designation at end of sequence. Example DBPS INT 202.1).
8. Interior Camera Mounted Viewing Interior Area: Abbreviated building name + INT + Floor + Abbreviated name of area viewed. Example DBPS INT 1st Lobby (if more

than one camera used for the same area include a decimal designator. Example DBPS INT 10th Hallway.1).

9. Power Supply: PWR + abbreviated installed location/building + number of room installed - number. Example PWR JCK INT 202-1.

### 3.4 RECORDS

- A. A record is a collection of information about or related to a specific element of the video surveillance system. Records must be maintained in a computer printable spreadsheet, or in a computer database. Paper records are encouraged, but are optional. A device and cable record is prepared for each device/door installation. The record will show the device/door name, and must describe the components from origin point and destination point. The device and cable record will record what services and/or connections are assigned to each installed location based on Equipped Door Number. An equipment record is prepared for services distributed from a certain piece of equipment, such as an encoder, controller, or a system.

### 3.5 DRAWINGS

- A. Drawings are used to illustrate different stages of video surveillance system installation planning, installation, and administration.
- B. Installation or Construction Drawings
  1. Installation or construction drawings are the plans that show the installer how the infrastructure and devices are to be installed. The quality of the installation can be directly impacted by the level of detail in the installation drawings and written specifications. Installation drawings shall show, at a minimum, device installation, show pathway locations and routing, configuration of video surveillance systems including door hardware installation, device installation, infrastructure, backboard and equipment rack configurations, and wiring details include identifier assignments.
- C. As-built Drawings
  1. The as-built drawings graphically document the installed video surveillance infrastructure through floor plan, elevation, and detail drawings. In many cases, these drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. As-built drawings are a vital component of the administration system, and must be kept current as adds, moves, and changes take place.

### 3.6 LABELING AND COLOR CODING

- A. It is important that both labeling and color coding be applied to all video surveillance devices, wiring, and infrastructure components. Labeling with the unique identifier will identify a particular component. Proper color coding will quickly identify how that component is used in the overall systems infrastructure of the facility.
- B. Labeling
  1. Labels are generally of either the adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.
  2. Outside plant labels shall be totally waterproof, even when submerged.
  3. All labels shall be machine printed.
  4. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.
  5. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used, and must be used in the manner intended by the manufacturer.
- C. Color Coding – Cable Termination Fields

1. Color coding shall be applied to all cables and cable termination fields in Telecommunications Closets, Equipment Rooms, and Entrance Facilities. Color coding may also be used to identify specific cables in a pathway, or the function of specific equipment racks or equipment. The same color is always applied to both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the plywood backboard behind the termination block, may be the color of a plastic cover on a termination block, or may be the actual color of the insert label on a termination block or patch panel. See Communications 27 05 28 1.01 A Construction Standards.

END OF SECTION

**SECTION 28 30 00 - FIRE ALARM AND DETECTION SYSTEMS - ADDRESSABLE - HORN****PART 1 - GENERAL****1.01 REFERENCE**

- A. Refer to Section 26 00 00 for requirements which are applicable to this section. All work required is not limited to this section.

**1.02 WORK INCLUDED**

- A. Provide labor, material, equipment and supervision necessary to install a complete electrically supervised microprocessor based, fully addressable type system as outlined in this section.
- B. Equipment by Siemens acceptable provided that design criteria is satisfied. Equipment by Silent Knight, Honeywell, Johnson Controls, or approved equivalent manufacturer is acceptable provided that all design criteria are satisfied.
- C. It is the intent of this specification and accompanying drawings to require the contractor and/or supplier of equipment and devices to provide a complete code compliant system which will obtain, as a minimum, the approval of the AHJ. Different suppliers may have devices which differ between each other and as such all devices necessary for approval shall be included in the scope of work whether specifically identified or not.
- D. Horns shall be audible as required by code in all spaces above ambient. Devices provided by manufacturers shall be selected to provide audibility with either additional horns or higher dB devices as necessary to achieve such approval.
- E. Strobes shall be visible as required by code in all spaces to meet requirements of the AHJ.
- F. All fire alarm system components are to be appropriately rated for the environment in which they are being installed. The fire alarm vendor is responsible for UL Listed device selections. Consideration shall be given to, but not be limited to, ambient temperature, water infiltration, dust infiltration, and humidity.
- G. In order to meet the approval of the AHJ, it may be necessary to add additional devices that are not indicated on the drawings. The contractor is to allow for additional devices and wiring.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product, including furnished options and accessories.
- B. Shop Drawings: For fire-alarm system.
  - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  - 2. Include plans, elevations, sections, details, and attachments to other work.
  - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
  - 4. Include voltage drop calculations for notification-appliance circuits.
  - 5. Include battery-size calculations.
  - 6. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.



7. Include performance parameters and installation details for each detector.
  8. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  9. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
- C. General Submittal Requirements:
1. Submit drawings to the local authority for permit and approval. Submit approved drawings to consulting engineers and to owner's insurance company and obtain approval prior to construction. All requirements for above approval are to be included with the work.
  2. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire-alarm system design.
    - b. NICET-certified, fire-alarm technician; Level III minimum.
    - c. Licensed or certified by authorities having jurisdiction.

#### 1.04 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Control of System: By the Fire Alarm Control Panel (FACP).
- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.
- E. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. System Alarm Capability during Circuit Fault Conditions: System wiring, and circuit arrangement prevent alarm capability reduction when an open circuit, ground or wire-to-wire short occurs, or an open circuit and a ground occur at the same time in an initiating device circuit, signal line circuit, or notification-appliance circuit.
- H. Loss of primary power at the FACP initiates a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.
- I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a smoke or flame or heat detector, or operation of a sprinkler flow device initiates the following:
  1. Notification-appliance operation (exterior bell/ strobe only operates with sprinkler flow devices).
  2. Identification at the FACP and the remote annunciator of the device originating the alarm.
  3. Transmission of an alarm signal to the remote alarm receiving station.
  4. Unlocking of electric door locks in designated egress paths.
  5. Release of fire and smoke doors held open by magnetic door holders.

6. Recall of elevator(s).
  7. Shutdown of fans and other air-handling equipment serving zone when alarm was initiated.
  8. Closing of smoke dampers in air ducts of system serving zone where alarm was initiated.
  9. Recording of the event in the system memory.
  10. \*Recording of the event by the system printer.
- J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP (and the Remote Annunciator).
1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
  2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- K. Water-flow alarm switch operation initiates the following:
1. Notification-appliance operation.
  2. Flashing of the device location-indicating light for the device that has operated.
  3. Notification-appliance operation on exterior.
- L. Operating a heat detector in the elevator shaft shuts down elevator power by operating the shunt trip in a (all) circuit breaker(s) feeding the elevator(s). Refer to 26 00 00 for sequence of operation.
- M. Water-flow alarm for connection to sprinkler in an elevator shaft and elevator machine room shuts down elevators associated with the location without time delay.
1. A field-mounted relay actuated by the fire detector or the FACP closes the shunt trip circuit and operates building notification appliances and annunciator.
- N. Smoke detection for zones or detectors with alarm verification initiates the following:
1. Audible and visible indication of an "alarm verification" signal at the FACP.
  2. General alarm if the alarm is verified.
  3. Cancellation of the FACP indication and system reset if the alarm is not verified.
- O. Sprinkler valve-tamper switch operation initiates the following:
1. A supervisory, audible, and visible "valve-tamper" signal indication at the FACP and the annunciator.
  2. Flashing of the device location-indicating light for the device that has operated.
  3. Transmission of supervisory signal to remote alarm receiving station.
- P. Fire-pump power failure, including a dead-phase or phase-reversal condition, initiates the following:
1. A supervisory, audible, and visible "fire-pump power failure" signal indication at the FACP and the annunciator.
  2. Transmission of trouble signal to remote alarm receiving station.
- Q. Low-air-pressure switch operation on a dry-pipe or pre-action sprinkler system initiates the following:
1. A supervisory, audible, and visible "sprinkler trouble" signal indication at the FACP and the annunciator.
  2. Flashing of the device location-indicating light for the device that has operated.
  3. Transmission of trouble signal to remote central station.
- R. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. Same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific

- detectors. Sensitivity adjustments and sensitivity-adjustment schedule changes are recorded in system memory and are printed out by the system printer.
- S. Removal of an alarm-initiating device or a notification appliance initiates the following:
    - 1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
    - 2. Transmission of trouble signal to remote alarm receiving station.
  - T. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

## PART 2 - PRODUCTS

### 2.01 CONTROL PANEL

- A. Fire Alarm Panel shall be surface mounted where shown on the drawings, with the following items.
  - UL Listed
  - Modular, microprocessor-based
  - Addressable locations of all devices
  - Zoned Visual Alarm and Trouble Indicators
  - Automatic Ground Detection
  - Lamp Test
  - Supervisory Voltage and Current Meters
  - Double Supervision
  - Field Programmable Fan Relays
  - Supervise Signal Circuit Modules
  - Annunciator Contacts by Zone
  - Dead Front Construction
  - Battery backup

### 2.02 SMOKE DETECTORS

- A. Furnish and install where shown on the drawings UL listed smoke detectors. Detector shall be solid state photoelectric type and shall operate on the light scattering, photo diode principle. Detector shall have an integral fixed temperature heat detector rated at 135°F.
- B. Detector shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

### 2.03 HORN/ STROBE

- A. Combination device with factory integrated audible and visible devices in a single mounting assembly. Horn shall be electric vibrating polarized type which produces 90 dB measured 10'-0" from the horn. Strobe shall be self-synchronizing, Xenon strobe lights with clear lens and rated light output of 15, 30, 60, 75, or 110 candelas.

### 2.04 STROBE

- A. Self-synchronizing, flush wall mounted, red housing, white letters, UL 1638 and UL 1971 compliant 15, 30, 60, 75, or 110 candelas as appropriate, mounted on single-gang box, clear Lexan flash tube enclosure.

#### 2.05 MINI-HORN/ STROBE

- A. Similar to Horn/ Strobe except 110 candela strobes, 75 dB measured at 10'-0".

#### 2.06 FIRE ALARM STATIONS

- A. Fire Alarm Stations shall be semi-flush mounted, non-code break glass type. Finish shall be red with white letters.
- B. Stations shall be addressable.

#### 2.07 HEAT DETECTORS

- A. Heat Detectors, furnished and installed where indicated on the drawings, shall be combination type, actuated by either a fixed temperature of 135°F or rate of rise of temperature that exceeds 15°F per minute.
- B. Detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

#### 2.08 DUCT SMOKE DETECTORS

- A. Furnish where indicted on the drawings or required elsewhere in the specifications air duct smoke detectors. Duct smoke detectors are to be furnished by the electrical contractor, installed by the mechanical contractor, and wired to the fire alarm system by the electrical contractor. They shall integrate photoelectric, ionization and heat sensing technologies for optimum detection accuracy and to prevent unwanted alarms. Auxiliary contacts shall be provided to shut down the air handling unit fan. The detector shall output to a remote alarm indicator.
- B. Detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

#### 2.09 REMOTE DEVICE LOCATION-INDICATING LIGHTS AND IDENTIFICATION PLATES

- A. Device shall contain LED indicating light near each smoke detector that may not be readily visible, and each sprinkler water-flow switch and valve-tamper switch. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identified, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

#### 2.10 WATERFLOW SWITCHES - TAMPER SWITCHES

- A. Water flow Switches and tamper switches shall be furnished and installed by the sprinkler contractor. Refer to sprinkler drawings and specs for locations and quantities.

- B. Switches shall be addressable. Electrical contractor shall wire to fire alarm system and to exterior bell/ strobe.
- C. Switches are supplied with two contacts, one for connection to fire alarm system and one for exterior bell/ strobe.

#### 2.11 DRY PIPE SYSTEM

- A. Furnish and install an air pressure monitoring alarm which shall provide a trouble signal if the dry pipe system air pressure falls outside its allowable range.

#### 2.12 TELEPHONE AUTO DIALER

- A. Furnish and install where indicated on the drawings or required elsewhere in the specifications a digital-type telephone auto dialer. The dialer shall call and notify a preprogrammed telephone number when in the alarm mode.

#### 2.13 MAGNETIC DOOR HOLDERS

- A. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Electromagnet shall require no more than three watts to develop 25 foot-pounds of holding force.
- B. Material and finish shall match door hardware.
- C. Units are to be rated for 24-volt AC, or DC operation.

#### 2.14 ADDRESSABLE INTERFACE DEVICE

- A. Device shall be Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.
- B. Integral Relay shall be capable of providing a direct signal to the elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.

#### 2.15 CARBON MONOXIDE DETECTOR (NEW JERSEY BOARDING FACILITIES)

- A. Digitally profiled Metal Oxide Semiconductor type sensor.
- B. 0 to 200 ppm detection range.
- C. Audible alarm (85 dB).
- D. LED indicators.
- E. White powder coat finish over steel housing.
- F. Used with monitoring module.
- G. 5,000 square foot coverage area.

#### 2.16 ANNUNCIATOR

- A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also, duplicate manual switching functions of the FACP, including acknowledging, silencing, reset, and test.
- B. Mounting: Flush cabinet, NEMA 250, Class 1.
- C. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

**2.17 SOUNDER BASE**

- A. Audible device to which smoke detector is mounted. 94dBA average sound output is to be synchronized throughout.

**2.18 EXTERIOR BELL AND STROBE**

- A. Weatherproof device(s) with factory integrated audible and visible devices in a single mounting assembly. Bell shall be 24-volt (nominal) which produces 83 dB measured at 10'-0". Strobe shall be Zenon type with clear lens and rated light output of 75 candelas or as required by the local Fire Marshal. Strobe shall be provided with clear weatherproof guard for physical protection and heater system to assure operation to -40°F.

**PART 3 - EXECUTION****3.01 SYSTEM OPERATION**

- A. Operation of any manual or automatic device shall cause all signals and strobes to sound. The annunciator will identify the specific location of the alarm initiation. Control and contacts for the building system shall function as required. Door hold opens shall be released. Door locks will be opened.

**3.02 WIRING**

- A. All wiring shall be run in conduit in exposed areas or Fire Alarm MC Cable in concealed spaces and shall be installed as recommended by the system manufacturer. Provide deduct alternate for use of type FPLP plenum rated fire alarm cable.
- B. Initiating device circuits are to be Class B (two-wire using NO contact initiating devices and an end of line resistor).
- C. Notification appliance circuits shall have polarized devices wired in parallel and be equipped an end of line resistor.

**3.03 EQUIPMENT INSTALLATION**

- A. Smoke detectors indicated on the drawings shall be located in the occupied space. A similar device layout shall be duplicated above suspended ceilings and/ or below raised floors as outlined in NFPA 72 for return air plenums.
- B. Connect the FACP with a disconnect switch with lockable handle or cover. Provide circuit label as per NFPA 72 requirements.
- C. Manual Pull Stations: Mount semi-flush in recessed back boxes.
- D. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised. Connect to exterior bell/ strobe (bell/strobe only operates with water flow).
- E. Ceiling-Mounted Smoke Detectors: Not less than 0'-4" (100mm) from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30'-0" (9m) apart in any direction.
- F. Wall-Mounted Smoke Detectors: At least, 0'-4" (100mm), but not more than, 1'-0" (300mm) below the ceiling.

- G. Smoke Detectors near Air Registers: Install no closer than 5'-0" (1,520mm).
- H. Duct Smoke Detectors: Comply with manufacturer's written instructions.
  - 1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  - 2. Install sampling tubes so they extend the full width of the duct.
  - 3. Install detectors in supply and return for all units 2,000 CFM and greater. Coordinate with mechanical documents for all units requiring detection. Note that one detector may be installed in lieu of two where directed by the authority having jurisdiction when units are between 2,000 CFM and 15,000 CFM.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- J. FACP and Auxiliary Booster Panels: Surface mount with tops of cabinets not more than 6'-0" (1,830mm) above the finished floor. Provide smoke detection for room in which the panel is located.
- K. Annunciator: Install with the top of the panel not more than 6'-0" (1,830mm) above the finished floor.
- L. Provide separate zone for each floor, not to exceed 20,000 square feet, length not to exceed 200'-0" in any direction.
- M. Provide where indicated on drawings, 15 candela horn/ strobes or strobes in non-sleeping rooms up to 20' x 20'. Provide 30 candela horn/ strobes or strobes in non-sleeping rooms up to 30' x 30'. Provide 110 candela horn/ strobes in all other spaces where indicated on drawings.
- N. Sounder bases are to be used for all smoke detectors within sleeping areas.
- O. Exterior Bell and Strobe: Install on exterior wall above the Fire Department sprinkler connection at a height of 12'-0" unless directed otherwise by the local Fire Marshal. Coordinate with fire protection contractor.
- P. For all magnetic door hold-open devices, a smoke detector is to be provided within 5'-0" of each doorway on both sides of the doorway. Coordinate with architect/ owner for magnetic door holder material, finish and mounting.

### 3.04 SERVICE

- A. A service contract shall be made available to the owner after the one-year warranty expires.
- B. A complete set of reproducible as-builts, showing installed wiring and color coding and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment shall be provided for the system.

### 3.05 TESTING

- A. Perform test of system according to procedures outlined in NFPA 72. Correct deficiencies, as necessary. Provide written record of inspections, tests, and test results in the form of a test log.

END OF SECTION

1 SECTION 311000 - SITE CLEARING

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes the following:

- 8 1. Protecting existing trees, shrubs, groundcovers plants and grass to remain.  
9 2. Removing existing trees, shrubs, groundcovers, plants and grass.  
10 3. Stripping and stockpiling topsoil.  
11 4. Removing above and below grade site improvements.  
12 5. Disconnecting, capping or sealing, and removing site utilities.  
13 6. Temporary erosion and sedimentation control measures.

- 14 B. Related Sections include the following:

- 15 1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary  
16 construction and support facilities, temporary security and protection facilities, and temporary  
17 erosion and sedimentation control procedures.  
18 2. Division 01 Section "Execution Requirements" for verifying utility locations and for recording  
19 field measurements.  
20 3. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.  
21 4. Division 32 Section "Lawns, Grasses and Exterior Plants" for finish grading including preparing  
22 and placing planting soil mixes and testing of topsoil material.

23 1.3 DEFINITIONS

- 24 A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay  
25 particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil;  
26 reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free  
27 of subsoil and weeds, roots, toxic materials, or other non-soil materials.

- 28 B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during  
29 construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees,  
30 unless otherwise indicated.

31 1.4 MATERIAL OWNERSHIP

- 32 A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials  
33 shall become Contractor's property and shall be removed from Project site unless otherwise acceptable to  
34 the Owner.



## 1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Division 01 Section "Project Record Documents," identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions as they may arise.

## 1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

## PART 2 - PRODUCTS

## 2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
  - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.

- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
  - 1. Do not store construction materials, debris, or excavated material within fenced area.
  - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
  - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
  - 1. Cover exposed roots with burlap and water regularly.
  - 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
  - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
  - 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.
  - 1. Employ an arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
  - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by Architect.

### 3.4 UTILITIES

- A. Contractor shall arrange for disconnecting and sealing utilities that serve existing structures before site clearing.

1. Verify that utilities have been protected, disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  1. Arrange with utility companies to shut off indicated utilities.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  1. Notify Owner not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Owner's written permission.
- D. Excavate for and remove underground utilities indicated to be removed (TBR).
- E. Removal of underground utilities is included in Division 33 Sections covering site utilities.

### 3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction and as noted.
  1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
  4. Remove stumps and other vegetation outside of the new construction area as indicated on plans. Restore these areas with seeding in order to provide an even and smooth surface matching the adjacent existing conditions.
  5. Use only hand methods for grubbing within tree protection zone.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

### 3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
  1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  1. Limit height of topsoil stockpiles to 35 feet.
  2. Do not stockpile topsoil within tree protection zones.
  3. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

## 1 3.7 SITE IMPROVEMENTS

2 A. Remove existing above and below-grade improvements as indicated and as necessary to facilitate new  
3 construction.

4 B. Remove slabs, paving, curbs, gutters, pole bases, fencing and aggregate base as indicated or as required.

## 5 3.8 DISPOSAL

6 A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste  
7 materials including trash and debris, and legally dispose of them off Owner's property.

8 1. Separate recyclable materials produced during site clearing from other non-recyclable materials.  
9 Store or stockpile without intermixing with other materials and transport them to recycling  
10 facilities.

11 2. Dispose of all materials in accordance with Federal, State and Local regulations.

12 END OF SECTION 311000

13

SECTION 312000 — EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Comply with recommendations in "Geotechnical Engineering Investigation & Study" report provided by Owner.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Preparing subgrade for slabs-on-grade, walks, pavements, lawns, grasses and exterior plants.
- 2. Excavating and backfilling for buildings and structures.
- 3. Subbase course for concrete walks and pavements.
- 4. Subbase and base course for asphalt paving.
- 5. Subsurface drainage backfill for walls and trenches.
- 6. Excavating and backfilling for utility trenches.

- B. Related Sections include the following:

- 1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.

- C. Contractor shall excavate, backfill, maintain swales and/or earth berms around their excavation until they are completely backfilled to prevent surface water runoff from entering the excavations. Contractor shall also immediately remove any water that does accumulate in their excavations, compact, grade and replace site surface materials, (including bituminous paving, concrete, top soil and grass areas), to match existing surfaces, or prepare for new surfaces, for the installation of the Work .

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

- 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- 3. Flowable Fill: Structural flowable fill or lean concrete used at excavated existing fill areas.

- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary

1 flow of pore water.

2 F. Excavation: Removal of material encountered above subgrade elevations and to lines and  
3 dimensions indicated.

4 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond  
5 indicated lines and dimensions as directed by Engineer. Authorized additional  
6 excavation and replacement material will be paid for according to Contract provisions for  
7 changes in the Work.

8 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

9 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated  
10 lines and dimensions without direction by Engineer. Unauthorized excavation, as well as  
11 remedial work directed by Engineer, shall be without additional compensation.

12 G. Fill: Soil materials used to raise existing grades.

13 H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders  
14 of rock material that exceed 1.5 cu. yd. for bulk excavation or for footing, trench, and pit  
15 excavation that cannot be removed by rock excavating equipment equivalent to the following in size  
16 and performance ratings, without systematic drilling, rain hammering, ripping, or blasting, when  
17 permitted:

18 1. Rock excavation for trenches and pits includes removal and disposal of materials and  
19 obstructions encountered that cannot be excavated with a track-mounted power  
20 excavator, equivalent to Caterpillar Model NO. 325B, 168 HP, 48,350 lb. drawbar pull and  
21 36 inch bucket rated at 1.0 cubic yard capacity. Trenches in excess of 10 feet in width  
22 and pits in excess of 30 feet in either length or width are classified as bulk  
23 excavation.

24 2. Rock excavation in bulk excavations includes removal and disposal of materials and  
25 obstructions encountered that cannot be dislodged and excavated with modern, track-  
26 mounted, heavy-duty excavating equipment without drilling or blasting. Rock excavation  
27 equipment is defined as Caterpillar Model No. 973 or equivalent track-mounted loader, rated at  
28 not less than 210 HP flywheel power and developing minimum of 45, 000 pound breakout force  
29 (measured in accordance with SAE J732).

30 a. Typical of materials classified as rock are boulders 1-1/2 cu. yd. or more in  
31 volume, solid rock in ledges, and rock-hard cementitious aggregate deposits.

32 b. Intermittent ripping performed to increase production and not necessary to permit  
33 excavation of material encountered will be classified as earth excavation.

34 Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of  
35 rock material 1 cu. yd. or more in volume that exceed a standard penetration resistance of 100  
36 blows/2 inches (97 blows/50 mm) when tested by an independent geotechnical testing agency,  
37 according to ASTM D 1586.

38 J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and  
39 electrical appurtenances, or other man-made stationary features constructed above or below the  
40 ground surface.

41 K. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt  
42 pavement, or course placed between the subgrade and a cement concrete pavement or a cement  
43 concrete or hot-mix asphalt walk.

44 L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill  
45 immediately below subbase, drainage fill, or topsoil materials.

46 M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground  
47 services within buildings.

## 1.4 SUBMITTALS

## A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Geotextile.

## B. Samples: 12-by-12-inch sample of separation geotextile.

## C. Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D 2487 of each borrow soil material proposed for fill and backfill. It is assumed that on-site soils can be used for the intended purposes.
2. Laboratory compaction curve according to ASTM D 1557 for each borrow soil material proposed for fill and backfill. It is assumed that on-site soils can be used for the intended purposes.
3. Test reports on borrow material.
4. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
5. Field test reports for in-place Soil Density Tests.
6. One optimum moisture-maximum density curve for each type of satisfactory soil which may be used as fill.
7. Field test report of actual unconfined compressive strength and/or results of Bearing Capacity Tests.
8. Report of satisfactory proof-rolling and/or testing of natural subgrade.

## D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

## 1.5 QUALITY ASSURANCE

## A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

## B. Engineer Qualifications: A professional Engineer legally registered in the State of Pennsylvania experienced in the design of concrete work and type of construction indicated on the drawings. Engineering services are defined as those performed for formwork, shoring and restoring installations that are similar to those indicated for the Project in material, design and extent.

## C. Testing and Inspection Service: Owner will employ and pay for a qualified independent geotechnical testing and inspection laboratory as needed to perform on-site soil testing and inspection service during earthwork operations. Testing and reports required for all off-site fill and all off-site testing shall be the Contractor's responsibility.

## D. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory geotechnical testing without delaying the progress of the Work.

## E. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

- F. Any work or material that does not meet the specified values or is determined to be in non-compliance shall be removed and replaced by the contractor at no additional cost to the Owner.

1.6 PROJECT CONDITIONS

- A. Site Information: Data in subsurface investigation reports was used for the basis of the design and is made available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings/test pits. The Owner, Engineer or Engineer will not be responsible for interpretations or conclusions drawn from this data by the Contractor.

- B. Additional test borings and other exploratory operations may be performed by the Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

- C. Existing Utilities: The Contractor shall call 800-242-1776 "One Call System" as indicated prior to performing excavation work.

1. Locate existing underground utilities in areas of excavation work prior to beginning excavation operations. Visibly mark or stake existing utilities for the duration of construction and renovations. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
2. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
3. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
4. Provide minimum 48-hour notice to Owner and receive written notice to proceed before interrupting any utility.
5. Demolish and completely remove from site existing underground utilities indicted to be removed. Coordinate with utility companies for shutoff of services if lines are active.

- D. Use of Explosives: Use of explosives is NOT permitted unless approved by Owner and local authority.

- E. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction. Traffic control for improvements along public roads shall be conducted in accordance with PennDOT Publication 213 and the requirements of the local authorities.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
3. Perform excavation by hand within drip line of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

- F. Vertical Limits of Responsibility: Contractor is responsible for excavation to the required subgrade elevations (cut) and not more than 12 inches below existing grade (fill) for bulk excavation and subgrade of structures and bottom of pipe, conduit or footings for trench excavation.



## PART 2 - PRODUCTS

## 2.1 SOIL MATERIALS

- A. General: All stone specified herein shall be natural stone. No slag permitted. Provide imported soil materials from one source only when sufficient satisfactory soil materials are not available from excavations. Contractor is responsible for site excess or shortage of fills.
- B. Topsoil: Fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones larger than 2 inches in any dimension and other extraneous or toxic matter harmful to plant growth.
1. Obtain topsoil from local sources or from areas having similar soil characteristics to that found at project site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth on not less than four (4) inches; do not obtain from bogs or marshes.
- C. Drainage Fill: Evenly graded mixture of natural or crushed gravel, or crushed stone complying with AASHTO No. 57 (PennDOT 2B), with 100 percent passing 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve. Wash stone thoroughly.
- D. Subbase Material (Exterior Concrete Pavements Only): Evenly graded mixture of natural or crushed gravel, or crushed stone complying with AASHTO No. 57 (PennDOT 2B), with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve. When stone is used as subbase for Portland cement concrete slabs or pavement, stone shall be washed thoroughly.
- E. Backfill, Fill and Borrow Materials: Satisfactory soil materials reasonable free of clay (maximum 25 percent) and sand (maximum 18 percent) and completely free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Material shall be capable of obtaining the specified moisture content and compaction requirements.
- F. Engineered Fill: 2A modified natural stone or other material approved by geotechnical engineer.
- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; AASHTO No. 8 aggregate at trench drains.
- H. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:

Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.

- 1           2.       Yellow: Gas, oil, steam, and dangerous materials.
- 2           3.       Orange: Telephone and other communications.
- 3           4.       Blue: Water systems.
- 4           5.       Green: Sewer systems.

- 5       B.     Weed Control: Granular form, Treflan, Ettam, or approved equal.

6       PART 3 - EXECUTION

7       3.1     PREPARATION

- 8       A.     Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by  
9             settlement, lateral movement, undermining, washout, and other hazards created by earthwork  
10            operations. Contractor shall include engineering and installation of any required shoring to  
11            perform the required construction.
- 12       B.     Preparation of subgrade: Remove existing vegetation, topsoil, debris, obstructions, and  
13             deleterious materials from ground surface.
- 14       C.     Protect and maintain erosion and sedimentation controls, which are specified in Division 31  
15             Section "Site Clearing," during earthwork operations.
- 16       D.     Provide protective insulating materials to protect subgrade and foundation soils against freezing  
17             temperatures or frost.

18       3.2     EXCAVATION, GENERAL

- 19       A.     Excavation for new Work is UNCLASSIFIED: Excavate to subgrade elevations regardless  
20             of the character of surface and subsurface conditions encountered. Unclassified  
21             excavated materials may include rock, soil materials, foundations, structures and obstructions.  
22             No changes in the Contract Sum or the Contract Time will be authorized for rock excavation,  
23             removal of obstructions or any other materials.
- 24       B.     Excavation Parameters:
- 25            1.     If excavated materials intended for fill and backfill include unsatisfactory soil materials  
26                    and rock, replace with satisfactory soil materials. No additional compensation will be  
27                    made for any soil materials.
- 28            2.     Remove rock to lines and grades indicated to permit installation of permanent  
29                    construction without exceeding the following dimensions:
- 30               a.    24 inches outside of concrete forms other than at footings.
- 31               b.    12 inches outside of concrete forms at footings.
- 32               c.    6 inches outside of minimum required dimensions of concrete cast against grade.
- 33               d.    Outside dimensions of concrete walls indicated to be cast against rock without  
34                    forms or exterior waterproofing treatments.
- 35               e.    6 inches beneath bottom of concrete slabs on grade.
- 36               f.    6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42  
37                    inches wide.
- 38       C.     Unauthorized Excavation: Unauthorized excavation, as well as remedial work directed by  
39             Engineer, shall be at Contractor's expense.

## 3.3 STABILITY OF EXCAVATIONS

- A. General: Comply with federal, state and local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Slope sides of excavations as required. Shore brace or line where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.
1. Provide permanent steel sheet piling or pressure-creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2'-6" below final grade and leave pennanently in place.

## 3.4 SINKHOLES:

- A. Recommended Procedures for Minimizing Sinkhole Development in Carbonate Areas: Areas underlain by carbonate rock formations are subject to solution activity and the development of sinkholes. Any disturbance of natural conditions at a given site tends to increase the potential for sinkhole development. The following construction procedures will help to minimize this potential.
1. Utmost care must be taken to prevent collection and drainage of surface water into excavated or low-lying areas of the site during the excavation and construction of roadways, ramps, or structures. This may be done by constructing earth berms, dikes, or diversion ditches around open excavations or otherwise preventing the collection and ponding of water in low-lying areas.
  2. The soil situated above a zone of solution activity is usually soft and wet. It is, therefore, important to locate areas exhibiting these conditions, wherever they may exist or be encountered. If structural fill is to be placed in areas suspected of sinkhole activity, the subgrade shall be proof-rolled and all soft areas suitable replaced and compacted prior to construction of the embankment. If the area is to be excavated, proof-rolling shall be conducted after excavating to the finished subgrade elevation. Proof-rolling shall be conducted using either a static roller weighing at least 10 tons or other equipment with a similar weight.
  3. Soft soil areas shall be removed and replaced with a clean, granular soil compacted in layers. All compacted soil shall be compacted to a density of at least 97 percent of the maximum dry density, as determined by ASTM Standard D 698, Standard Proctor Test.
  4. The base of all excavations in carbonate areas shall be inspected for soft or unusually moist conditions. A visual inspection of the excavated surface, as well as probes of the soil at regular intervals, is required. Any soft or unusually moist soil shall be further excavated and a determination of the extent of the problem be made. Remedial measures should then be undertaken as necessary.
  5. Excavation should be kept to a practical minimum.

## 3.5 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Maintain positive slope of site excavation to prevent ponding of water on areas to receive paving or slabs.

B. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches. Comply with soil erosion control plan.

### 3.6 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Whether indicated or not, bottom of footings shall be a minimum of 4'-0" below grade finish grade. Adjust as required including excavation and backfill at no additional cost to Owner.

### 3.7 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrade. Unless noted otherwise, maintain subgrade with same slope and pitch as indicated for finish surface.

### 3.8 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

- 1 D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for  
2 bedding course. Hand excavate for bell of pipe.

- 3 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding  
4 bearing material to allow for bedding course.

5 3.9 SUBGRADE INSPECTION

- 6 A. Notify Engineer when excavations have reached required subgrade.

- 7 B. If the Engineer/Geotechnical Engineer determines that unsatisfactory soil is present, continue  
8 excavation and replace with compacted backfill, engineered fill, flowable fill, and lean concrete or  
9 fill material as directed by RPE.

- 10 C. Authorized additional excavation and replacement material will be paid for according to  
11 Contract provisions for changes in the Work.

- 12 D. Reconstruct subgrade damaged by freezing temperatures, frost, rain, accumulated water, or  
13 construction activities, as directed by Engineer, without additional compensation.

14 3.10 UNAUTHORIZED EXCAVATION

- 15 A. Fill unauthorized excavation under foundations or wall footings by extending bottom  
16 elevation of concrete foundation or footing to excavation bottom, without altering top  
17 elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used  
18 when approved by Engineer.

- 19 1. Fill unauthorized excavations under other construction or utility pipe as directed by  
20 Engineer.

21 3.11 COLD WEATHER PROTECTION

- 22 A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35  
23 degrees F.

- 24 B. Comply with the requirements of ACI 306R-88 and in particular, Chapter 4 — Preparation  
25 before Concreting.

26 3.12 STORAGE OF SOIL MATERIALS

- 27 A. Stockpile excavated materials acceptable for backfill and fill. Place, grade, and shape stockpiles for  
28 proper drainage.

- 29 B. Maintain separate soil stockpiles from Work performed by others on the adjoining property.  
30 Cooperate with placement and removal by others. Only suitable fill is to be placed on the work  
31 site by others.

- 32 C. General Contractor is responsible for final grading and seeding of the entire stockpile area at  
33 final completion unless agreed to otherwise in writing by the Owner.

- 34 D. Locate and retain soil materials away from edge of excavations. Do not store within drip line of  
35 trees indicated to remain.

- 1 E. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.
- 2 3.13 BACKFILL
- 3 A. Place and compact backfill in excavations promptly, but not before completing the following:
- 4 1. Construction below finish grade including, where applicable, sub drainage, damp  
5 proofing, waterproofing, and perimeter insulation.
- 6 2. Surveying locations of underground utilities for Record Documents.
- 7 3. Testing and inspecting underground utilities.
- 8 4. Removing concrete formwork.
- 9 5. Removing trash and debris.
- 10 6. Removing temporary shoring and bracing, and sheeting.
- 11 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- 12 B. Place backfill on subgrade free of mud, frost, snow, or ice.
- 13 3.14 UTILITY TRENCH BACKFILL
- 14 A. Place backfill on subgrade free of mud, frost, snow, or ice.
- 15 B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding  
16 course to provide continuous support for bells, joints, and barrels of pipes and for joints,  
17 fittings, and bodies of conduits.
- 18 C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with  
19 satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in  
20 Division 3 Section "Cast-in-Place Concrete."
- 21 D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below  
22 surface of roadways. After installing and testing, completely encase piping or conduit in a  
23 minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- 24 E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any  
25 dimension, to a height of 12 inches over the utility pipe or conduit.
- 26 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both  
27 sides and along the full length of utility piping or conduit to avoid damage or  
28 displacement of piping or conduit. Coordinate backfilling with utilities testing.
- 29 F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height  
30 of 12 inches over the utility pipe or conduit.
- 31 G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- 32 H. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- 33 I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final  
34 subgrade elevation.
- 35 J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below  
36 subgrade under pavements and slabs.
- 37 3.15 SOIL FILL

- 1 A. General: The Contractor shall protect excavated material which he intends on reusing as fill or  
2 backfill. Contractor shall stock-pile and protected excavated satisfactory soil and is responsible for  
3 maintaining the quality of this soil.
- 4 B. Preparation: Remove vegetation, topsoil, debris, wet and unsatisfactory soil materials, obstructions, and  
5 deleterious materials from ground surface prior to placing fills.
- 6 C. When subgrade or existing ground surface to receive fill has a density less than that required for  
7 fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and  
8 recompact to required density.
- 9 D. Proof-rolling: Proof roll the natural subgrade under all walls, pavements and concrete slabs prior to  
10 placing subbase or compacted fill material.
- 11 E. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will  
12 bond with existing material.
- 13 F. Place and compact fill material in layers to required elevations as follows:
- 14 1. Under grass and planted areas, use satisfactory soil material.  
15 2. Under walks and pavements, use satisfactory soil material.  
16 3. Under steps and ramps, use engineered fill.  
17 4. Under building slabs, use engineered fill and drainage fill.  
18 5. Under footings and foundations, use engineered fill.  
19 6. Where voids are left by boulder removal use subbase or base material or satisfactory soil or  
20 borrow material.  
21 7. Under Portland Cement Concrete Paving and steps, use drainage fill material.  
22 8. Under footings, piping, conduit and equipment that come within 6 inches above the rock  
23 bearing surface or for correction of unauthorized excavation, use subbase materials or  
24 engineered fill as directed by Engineer.  
25 9. Under footings and foundations where poor soil was removed, use engineered fill.
- 26 G. Place soil fill on subgrade free of mud, frost, snow, or ice.

### 27 3.16 SOIL MOISTURE CONTROL

- 28 A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before  
29 compaction to within 2 percent of optimum moisture content. No additional compensation will be  
30 made for Contractor to correct soils for optimum moisture content.
- 31 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain  
32 frost or ice.
- 33 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material  
34 that exceeds optimum moisture content by 2 percent and is too wet to compact to  
35 specified dry unit weight.

### 36 3.17 COMPACTION OF SOIL BACKFILLS AND FILLS

- 37 A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials,  
38 obstructions, and deleterious materials from ground surface to natural subgrade prior to  
39 placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so  
40 that fill material will bond with existing surface.
- 41 1. When existing ground surface has a density less than that specified under

"Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

B. Proof roll natural subgrade with a minimum 7-1/2 ton roller equal to Caterpillar Model C5433. Areas which indicated a "pumping" action shall be excavated in one (1) foot intervals, or as directed, and re-proof rolled until "pumping" action no longer exists.

C. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for cohesive soils determined in accordance with ASTM D 1557 (Modified Proctor Test): and not less than the following relative density for cohesionless soils determined in accordance with ASTM D 4253 and D 4254:

- a. Under Structures, Building Slabs and Steps, and Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.
- b. Under Lawn or Unpaved Areas: Compact top 6 inches of natural subgrade and each layer of backfill or fill material at 85 percent maximum density for cohesive soils and 90 percent relative density for cohesionless soils.
- c. Under Walkways: Compact top 6 inches of natural subgrade and each layer of backfill or fill material at 90 percent maximum density for cohesive soils and 95 percent relative density for cohesionless soils.

### 3.18 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

- 1. Provide a smooth transition between adjacent existing grades and new grades.
- 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrade to required elevations within the following tolerances:

- 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
- 2. Walks: Plus or minus 1 inch.
- 3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.20A FINISH GRADING



- A. Seeded Areas: Cover areas designated to be seeded with a minimum of 4 inches of topsoil to finish grades indicated.

If there is a deficiency of topsoil, provide clean topsoil from an outside source without additional cost to the Owner.

### 3.19 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrade free of mud, frost, snow, or ice.

- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase and base course to required crown elevations and cross-slope grades.
4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

- D. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

1. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

### 3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.

- B. Allow testing agency to inspect and test subgrade and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work complies with requirements.

- C. Footing Subgrade: At footing subgrade, at least one test of each soil stratum will be performed to verify design-bearing capacities. Subsequent verification and approval of other footing subgrade may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrade, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

F. If in opinion of the Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, replace material and perform additional compaction and testing until specified density is obtained.

### 3.21 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

B. Soil Erosion Control: Comply with requirements of the Pennsylvania Department of Environmental Resources' "Soil Erosion and Sedimentation Control Manual" (Latest Edition). Secure forms and permits necessary and if required, provide an erosion and sedimentation control plan.

### 3.22 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. UNLESS OTHERWISE APPROVED, remove unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

B. DO NOT remove topsoil from site.

C. IF APPROVED AND DIRECTED BY OWNER: Transport surplus satisfactory, topsoil and soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Owner.

END OF SECTION 312000

SECTION 312301 — EXCAVATION, BACKFILL AND COMPACTION OF UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Excavation, backfill and compaction associated with utility construction including such related features as protection of adjacent utilities and structures, maintenance and protection of traffic, cutting paved surfaces, support of excavation, control of excavated materials, dewatering, piping, bedding, disposal of excavated materials, and all work related to providing excavation, backfill and compaction for all site utilities and structures in connection with water mains, storm sewage system, and natural gas.

1.3 RELATED SECTIONS

- A. Related Work Specified Elsewhere:
1. Division 31 Section: "Earth Moving".
  2. Division 33 Section: "Storm Drainage Utilities".

1.4 QUALITY ASSURANCE

- A. Testing Agent:
1. Compaction testing for this Work shall be performed by the Owner's Testing Agency. Where compaction testing is specified, a soil-testing agent engaged and paid for by the Owner will perform such compaction testing.
  2. Compaction testing for this Work that does not meet specified values shall be removed, replaced and or remediate by the contractor at no additional cost to the Owner.

B. Reference Standards:

1. Pennsylvania Department of Transportation:
  - a. Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)
  - b. Publication 408 Specifications Pennsylvania Test Method, PRM 106 Pennsylvania Test Method, PTM 402
  - c. Publication 213, Work Zone Traffic Control
  - d. Aston Township Zoning, Land Development and other applicable ordinances.

2. American Society for Testing and Materials (ASTM):

a. ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort

b. ASTM D2922 Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

C. Compaction Testing:

1. Compaction shall be by the testing procedure contained in ASTM D2922 based on previously determined compaction curve data as established by ASTM D698.

1.5 SUBMITTALS

A. Certificates:

1. Submit certification attesting that the composition analysis of pipe embedment and select material stone backfill materials meet specification requirements.

1.6 JOB CONDITIONS

A. Permits: Obtain and pay for all permits and inspections required for the work under this Section.

B. Excavation and Rock Removal:

1. Excavation for new work is UNCLASSIFIED. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered.

C. Compaction of Backfill:

1. Excavations shall be backfilled with lifts, which are individually compacted.

2. The following compaction densities (based on modified Proctor Curve ASTM D 1557) shall be achieved:

a. Trench Backfill under asphalt and concrete paving (not including base course materials): 95%

b. Trench Backfill within Unpaved Areas: 92%

c. Exterior Side of Structures: 95%

3. Contractor shall maintain optimum moisture content of backfill materials to attain the required compaction density.

D. Protection of Existing Utilities and Structures:

1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Act 287 as amended by Act 181 of 2006 by the General Assembly of Pennsylvania, advise each Utility at least three (3) working days in advance of intent to excavate, do demolition work and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.

2. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations. Contractor shall include engineering and installation of any required shoring to perform the required construction.
3. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect and procedures to follow to prevent damage.
4. Immediately report to the Utility and the Engineer any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
5. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

## PART 2 - PRODUCTS

### 2.1 DETECTABLE WARNING TAPE

- A. Acid and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, including storm water, 6 inches wide, 4 mils thick, continuously inscribed with a description of the utility with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep, colored as directed by authorities having jurisdiction on the project or as directed by the Engineer.

### 2.2 PIPE BEDDING OR EMBEDMENT MATERIAL

- A. AASHTO No 57 (PennDOT No. 2b) crushed aggregate, Table C, Section 703.2, Publication 408 Do not use slag or cinders.

### 2.3 SLAB OR BASE MATERIAL

- A. Concrete Slab or Precast Base: AASHTO No. 57 (PennDOT No. 2b) crushed aggregate, Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.

### 2.4 BACKFILL MATERIAL FOR UTILITIES, STORM WATER AND OTHER PIPING AND ACCESSORIES

- A. All Concrete and Asphalt Paving:

1. Over top of pipe: On-site satisfactory soil materials reasonably free of clay (maximum 25 percent) and sand (maximum 18 percent) and completely free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Material shall be capable of obtaining the specified moisture content and compaction requirements. PennDOT 2RC fill if on-site soil is unsuitable.

## PART 3 - EXECUTION

## 3.1 EXAMINATION AND PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Notify Engineer of unexpected subsurface conditions and discontinue work in area until notified to resume work.
- C. Maintain and protect existing utilities identified by utility users within the Work area.
- D. Verify that structure walls are braced to support surcharge forces imposed by backfilling operations.

## 3.2 PROTECTION OF ADJACENT WORK

- A. Underpin adjacent structures, which may be damaged by excavation work, including utilities and pipe chases.
- B. Grade excavation top perimeter to prevent surface water runoff into excavation or to adjacent properties.

## 3.3 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to ensure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the roadway is authorized.
- B. Maintain access to all streets and private drives.
- C. Provide and maintain signs, flashing warning lights, barricades, markers and other protective devices as required to conform with construction operations and to keep traffic flowing with minimum restrictions. Traffic control for improvements along public roads shall be conducted in accordance with PennDOT Publication 213 and the requirements of Salisbury Township.
- D. Comply with State and local Municipal codes, permits and regulations.
- E. Local Municipal Approvals & Permits: The Contractor shall submit, with NO mark-up, the cost of any permits or inspection fees required for the work. The Owner will reimburse the Contractor for fees paid to the authorities having jurisdiction. The Contractor shall secure and arrange for all the necessary utility connections and municipal for all agency approvals required for the Project unless specified otherwise.

## 3.4 CUTTING PAVED SURFACES

- A. Where installation of pipelines, structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the edge of the excavation. Cut offsets at right angles to the edge of the excavation.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.
- C. The requirement for neat line cuts, in other than state highways, may be waived if the final paving restoration indicates overlay beyond the width of the excavation.

## 3.5 EXCAVATION

## A. Depth of Excavation:

1. Pipelines: Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
2. Where unsuitable bearing material including shattered rock due to drilling or other operations is encountered in the bottom of the excavation, discontinue excavation until the unsuitable material is observed by the Engineer or the Owner's representative.
3. Where contractor, by error or intent, excavates beyond the minimum required depth, backfill the excavation to the required depth with pipe bedding/embedment or slab/base material as appropriate without any change in the Contract Price.

## B. Width of Excavation:

1. Pipelines:
  - a. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe or to minimum width specified on drawings, and for placing and compacting pipe embedment under, around and over the pipe.
  - b. Shape trench walls completely vertical from trench bottom to at least two (2) feet above the top of the pipe.
  - c. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that
2. Structures:
  - a. Excavate to the minimum distance necessary for placement/installation of the footings, concrete slab, walls or prefabricated structures and to permit proper backfill procedures to be performed.

## C. Length of Open Trench:

1. Do not advance trenching operations more than 200' ahead of completed pipeline or what can be completed in the same day.

## 3.6 SUPPORT OF EXCAVATION

- A. Support excavations with sheeting, shoring, and bracing or in the case of pipeline construction, "trench box" as required that comply with Federal, State, and local laws and codes.
- B. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of contractor in any other manner, shall be repaired at contractor's expense.
- C. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the Engineer.
- D. The neglect, failure or refusal of the Engineer, Owner or Engineer to order the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to order

sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as to the manner or methods of placing or driving sheeting's, bracing, jacks, wales, stringers, etc., shall not in any way or to any extent relieve Contractor of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor shall any delay, whether caused by any action or want of action on the part of Contractor, or by any act of Owner and Engineer or their agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of their obligations under the Contract relating to injury to persons or property, nor entitle them to any claim for extra compensation.

### 3.7 CONTROL OF EXCAVATED MATERIAL

- A. Keep the ground surface, within a minimum of 2' of the sides of the excavation, free of excavated material.
- B. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters and stone drains.
- C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural watercourses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- D. In areas where excavations parallel or cross-streams, ensure that no material slides, is washed, or dumped into the stream course.

### 3.8 DEWATERING

- A. Ground water is to be anticipated on this site.
- B. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- C. Prevent surface and ground water from entering excavations, provide and install dewatering measures to remove water from all excavations.
- D. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.
- E. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water. See Section 312000 for requirements of Sinkhole Development Potential, which shall be made a part of these specifications.
- F. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

### 3.9 PIPE LAYING

- A. Provide required pipe bedding placed in accordance with the Drawings and Specifications. A minimum



bedding of 6 inches shall be provided.

B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

C. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

D. The clay dike in trench restoration where indicated shall be 12 inch thick and be compacted to not less than 98 percent maximum dry density in accordance with ASTM D 698.

### 3.10 BACKFILLING EXCAVATIONS

#### A. Pipeline Trench:

1. After pipe installation and inspection, provide material to complete the pipe embedment in accordance with the Drawings and Specifications.

2. The material shall be hand placed and carefully compacted with hand operated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material in accordance with the Drawings and any relevant permit conditions. Employ a placement method so not to disturb or damage the utility line in the trench. Use of a Hydra-hammer °dumping jack type compaction device is not permitted. A vibratory plate type compaction device is acceptable. Any settlement, which occurs because of consolidation of the backfill during the construction period or during the one (1) year maintenance period, shall be completely corrected by contractor at his expense.

3. Provide clay dikes as indicated.

4. Provide warning tape approximately 12 inches below finished grades and above all piping.

#### B. Lift Thickness Limitations:

1. Lift thicknesses shall be limited to four (4) inches for pipe embedment, eight (8) inches maximum for pipeline trenches within paved areas and non-paved areas and for structure excavations. Lift thicknesses shall also comply with requirements imposed by any State Highway Occupancy Permit. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations for the compaction equipment to be utilized. Compaction equipment shall not be used over the pipe until sufficient backfill has been placed to insure that such equipment will not damage or disturb the pipe.

2. Lift thickness limitations specified for State or local highways, shoulders or embankments govern over the compaction equipment manufacturer's recommendations.

#### C. Unsuitable Backfill Material:

1. Where the Engineer determines backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with suitable backfill material. The contractor shall legally dispose of, unsuitable material off site.

- D. The clay dike in trench restoration shall be 24 inches thick and be compacted to not less than 98 percent maximum dry density in accordance with ASTM D 698.

### 3.11 FIELD QUALITY CONTROL

- A. Quality Control testing During Construction: Contractor shall coordinate with Owners a testing laboratory to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method) as applicable.

- a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.

- b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer.

2. Perform one test at each structure per foot of backfill and one test for each 50 lineal feet of pipe or fractions thereof, per foot of backfill.

3. If in the opinion of the Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

### 3.12 DISPOSAL OF EXCAVATED MATERIAL

- A. Excavated material remaining after completion of backfilling shall remain the property of the contractor, removed from the construction area, and disposed of legally, off-site. However, in the event the excavated material can be used in filling and rough grading on the site as determined by the Engineer, it shall remain on the site and be used for grading and filling.

END OF SECTION 312301

1 SECTION 312319 - DEWATERING

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section includes construction dewatering.

- 8 B. Related Requirements:

- 9 1. Section 013233 "Photographic Documentation" for recording preexisting conditions and  
10 dewatering system progress.  
11 2. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-  
12 water runoff and ponding.  
13 3. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and  
14 avoid delays.  
15 4. Review condition of site to be dewatered including coordination with temporary erosion-control  
16 measures and temporary controls and protections.  
17 5. Review geotechnical report.  
18 6. Review proposed site clearing and excavations.  
19 7. Review existing utilities and subsurface conditions.  
20 8. Review observation and monitoring of dewatering system.

21 1.3 ACTION SUBMITTALS

- 22 A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional  
23 engineer.

- 24 1. Include plans, elevations, sections, and details.  
25 2. Show arrangement, locations, and details of wells and well points; locations of risers, headers,  
26 filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and  
27 disposal of water.  
28 3. Include layouts of piezometers and flow-measuring devices for monitoring performance of  
29 dewatering system.  
30 4. Include written plan for dewatering operations including sequence of well and well-point  
31 placement coordinated with excavation shoring and bracing and control procedures to be adopted  
32 if dewatering problems arise.

33 1.4 INFORMATIONAL SUBMITTALS

- 34 A. Field quality-control reports.

B. Existing Conditions: Using **photographs or video recordings**, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

C. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in dewatering work.

## 1.6 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
2. The geotechnical report is **referenced** elsewhere in Project Manual.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
  - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
  - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified in [Section 015000 "Temporary Facilities and Controls,"] [Section 311000 "Site Clearing,"] during dewatering operations.

## 3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
  - 1. Space well points or wells at intervals required to provide sufficient dewatering.
  - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

## 3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
3. Maintain piezometric water level a minimum of **24 inches** below bottom of excavation.

C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of **36 inches** below overlying construction.

### 3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

B. Survey-Work Benchmarks: Resurvey benchmarks **regularly** during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

D. Prepare reports of observations.

### 3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

SECTION 312500 — SEDIMENTATION AND EROSION CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of sedimentation and erosion control systems work is indicated on drawings and schedules, and by requirements of this section and all regulatory bodies having jurisdiction on this work.

1. See drawings for narrative on sedimentation and erosion control and for additional information related to sedimentation and erosion control.
2. Implement and maintain the Soil and Sedimentation Control Plan prepared for this project.

- B. Contractor shall carry out the construction operations in a manner that soil erosion and resulting turbid storm water runoff and sedimentation are minimized.

- C. Comply with staging of earthmoving activities.

- D. Contractor will be required to be co-permittee for all E&S permitting.

- E. Compliance with direction of local Conservation District officials.

- F. Sedimentation and erosion control measures must meet the erosion and sedimentation requirements of the 2012 EPA Construction general permit, or local erosion and sedimentation controls standards and codes, whichever is more stringent. The plan shall meet the following objectives:

1. Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protection of topsoil by stockpiling for reuse.
2. Prevent sedimentation of storm sewer or receiving streams.
3. Prevent polluting the air with dust and particulate matter.

1.3 RELATED SECTIONS

- A. Related Sections include the following:

1. Division 31 Section: "Earth Moving".
2. Division 31 Section: "Excavation, Backfill and Compaction of Utilities".

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of sedimentation and erosion control system products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with sedimentation and erosion control work similar to that required for project.
- C. Codes and Standards: Comply with all Federal, State and Local regulations on this work.
  1. Comply with Pennsylvania Department of Environmental Resources Soil and Erosion and Sedimentation Control Manual.
  2. Pennsylvania Department of Transportation Publication 408 Specification.
- D. Environmental Compliance: Comply with applicable portions of the respective County Conservation District regulations pertaining to sedimentation and erosion control systems.

#### 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for all sedimentation and erosion control materials and products.
- B. Local Municipal Approvals & Permits: The Contractor shall submit, with NO mark-up, the cost of any permits or inspection fees required for the work. The Owner will reimburse the Contractor for fees paid to the authorities having jurisdiction. The Contractor shall secure and arrange for all the necessary utility connections and municipal for all agency approvals required for the Project unless specified otherwise.

#### 1.6 PROJECT/SITE CONDITIONS

- A. Associated work activities include but are not limited to the following items:
  1. Temporary and permanent measures will have to be undertaken before, during and after construction to control sediment from being carried onto adjoining properties and into swales or watercourses as a result of storm water runoff.
  2. The use of temporary control devices as shown on the Drawings and as described in these Specifications are for providing the trapping of sediment resulting from construction activities and to reduce the velocities of the temporary storm water courses to minimize erosion.
  3. The erosion and sediment control devices shall be inspected weekly and at every storm event and maintained throughout the life of this project. These shall include, but are not limited to, silt barrier fences, temporary sediment basins and traps, rock energy dissipaters, inlet protection, temporary seeding, etc. as shown on the Drawings or other measures that are required for the construction of this project.
  4. Upon completion of the project and after the temporary erosion control devices have served their purpose, these temporary devices shall be removed from the project by Contractor.
  5. Soil erosion and sedimentation control practices shall be consistent with the procedures



outlined in the latest edition of the "Soil Erosion and Sedimentation Control Manual".  
Commonwealth of Pennsylvania, Department of Environment Protection, and as shown on  
the drawings.

6. Contractor shall keep all public thoroughfares and all on-site paved areas free of mud and similar debris from construction activities throughout the entire construction period.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Silt Barrier Fence:

1. Section 865, Publication 408 Specifications.
2. As indicated on the drawings.

#### B. Inlet Filters:

1. As indicated on drawings

#### C. Temporary Seeding, Rock Filters, Sedimentation Basins with Appurtenances, Inlet Protection, etc.:

1. As indicated on drawings

#### D. Water Filter bag

1. As indicated on the drawings

#### E. Soil Erosion Control Matting

1. North American Green, or equal as indicated on the drawings

#### F. Geotextile Material

1. As indicated on the drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Erection and maintenance of silt barrier fences as indicated on the drawings.
- B. Construction of Sediment Traps and all associated appurtenances as indicated on the drawings.
- C. Installation of Inlet Filtering Devices as indicated on the drawings.
- D. Limiting the removal of natural ground cover to the minimum area required for grading and construction.
- E. Stabilizing all areas on which earthmoving activities have ceased and will be further subjected to earthmoving with an application of straw or woodchips at the prescribed rates.
- F. Performing temporary seeding and mulching within seasonal constraints, of disturbed areas

1 which are expected to remain bare of vegetation until final grading and stabilization can be  
2 accomplished.

3 G. The dewatering or pumping out of excavated areas directly into existing storm ditches or natural channels,  
4 which cause silt deposition, turbidity and/or possible erosion of banks is prohibited. Contractor must  
5 make use of sediment traps, filters, or other methods acceptable to the Engineer.

6 H. Provide geotextile fabric under rocks where shown. Place rocks carefully in the fabric to  
7 produce an even distribution with a minimum of voids and without tearing the geotextile fabric. Arrange  
8 rocks in full thickness in one operation in a manner to prevent segregation and rearranged as  
9 necessary to ensure uniform distribution.

10 3.2 FIELD MODIFICATIONS

11 A. Owner reserves the right to add to, delete, or modify any or all sediment control measures  
12 described herein as required to establish proper soil erosion and sedimentation control and  
13 comply with all agencies and regulatory bodies having jurisdiction on this work and project.

14 END OF SECTION 312500

SECTION 321216 – FLEXIBLE ASPHALT PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. This Section includes the following:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt paving overlay.
3. Asphalt surface treatments.
4. Pavement-marking paint.
5. Cold milling of existing hot-mix asphalt pavement.

1.4 SYSTEM DESCRIPTION

Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of Pa.DOT. Pub 408 Latest Edition

1.5 SUBMITTALS

Submit for approval product data, test reports from a PADOT certified supplier.

1.6 QUALITY ASSURANCE

Comply with Pa.D.O.T. publication 408 latest edition for asphalt paving work.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
- For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242 rock or slag dust, hydraulic cement, or other inert material.

### 2.2 ASPHALT MATERIALS

Asphalt Binder: AASHTO MP 1

Asphalt Cement: ASTM D 3381 for viscosity-graded material

Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

Water: Potable.

### 2.3 AUXILIARY MATERIALS

- A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying PADOT Publication 408 Section 962.

Color:

Parking Bays – White

Handicapped Designated Spaces - Blue

### 2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes per PADOT Publication 408 specifications from a PADOT certified supplier:
- Surface Course: Superpave Asphalt Mixture Design, HMA Wearing Course, 0.3 to 3 million design ESALS, 9.5 mm Mix, 1.5" Depth, SRL
  - Binder Course: Superpave Asphalt Mixture Design, HMA Binder Course, 0.3 to 3.0 million

- 1 design ESALS, 19 mm Mix, 2.5" Depth, SRL
- 2 3. Base Course - Superpave Asphalt Mixture Design, HMA Base Course, 0.3 to 3 million design
- 3 ESALS, 25 mm mix, Depths as Specified, SRL
- 4 4. Subbase – Compacted 8" No. 2A Stone

## 5 PART 3 - EXECUTION

### 6 3.1 EXAMINATION

- 7 A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- 8 B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require
- 9 further compaction.
- 10 C. Proceed with paving only after unsatisfactory conditions have been corrected.

### 11 3.2 COLD MILLING

- 12 A. Clean existing pavement surface of loose and deleterious material immediately before cold milling.
- 13 Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
- 14 1. Mill areas and remove existing subbase to a depth of 4.0" within areas identified on plans
- 15 2. Mill to a uniform finished surface free of gouges, grooves, and ridges.
- 16 3. Control rate of milling to prevent tearing of existing asphalt course.
- 17 4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
- 18 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate
- 19 from milled hot-mix asphalt.

### 21 3.3 SURFACE PREPARATION

- 22 A. General: Immediately before placing asphalt materials, remove loose and deleterious material from
- 23 substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- 24 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge
- 25 or disturb aggregate embedded in compacted surface of base course.
- 26 B. Tack Coat: Apply uniformly to surfaces of existing pavement and concrete at a rate of 0.05 to 0.15
- 27 gal./sq. yd.
- 28 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
- 29 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove
- 30 spillages and clean affected surfaces.

### 31 3.4 HOT-MIX ASPHALT PLACING

- 32 A Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix
- 33 by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each
- 34 course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt binder course in maximum 4" lifts.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.5 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F

- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

## 3.6 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Binder Course: Plus or minus ¼ inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: [1/4 inch]
2. Surface Course: [1/8 inch]

## 3.7 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Allow paving to age for 15 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal.

E. Provide pavement markings for all proposed parking spaces, crosswalks, and where indicated.

## 3.15 FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

## 3.16

1 DISPOSAL

2 A. Except for material indicated to be recycled, remove excavated materials from Project site and legally  
3 dispose of them in an EPA-approved landfill.

4 1. Do not allow excavated materials to accumulate on-site.

5 END OF SECTION 321216



## 1 SECTION 321313 - CONCRETE PAVING

## 3 PART 1 GENERAL

## 4 1.1 RELATED DOCUMENTS

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

## 7 1.2 RELATED DOCUMENTS

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

## 10 1.3 SUMMARY

- 11 A. This Section includes exterior cement concrete pavement for the following:

- 12 1. Curbs and gutters.  
13 2. Sidewalks.  
14 3. Exterior concrete pads.  
15

- 16 B. Related Sections include the following:

- 17 1. Division 03 Section "Cast-in-Place Concrete": General applications of concrete, including ramps and  
18 steps.  
19 2. Division 07 Section "Joint Sealants": Joint sealants within concrete pavement and at isolation joints  
20 of concrete pavement with adjacent construction.  
21 3. Division 31 Section "Earth Moving": Subgrade preparation, grading, and subbase course.  
22

## 23 1.4 DEFINITIONS

- 24  
25 A. Cementitious Materials: Portland cement alone or in combination with one or more of the following:  
26 blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag (GGBFS),  
27 and silica fume; subject to compliance with requirements.  
28

## 29 1.5 SUBMITTALS

- 30  
31 A. Product Data: For each type of manufactured material and product indicated.  
32  
33 B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of  
materials, project conditions, weather, test results, or other circumstances warrant adjustments.  
34  
35 C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies  
with requirements:  
36 1. Cementitious materials and aggregates.  
37 2. Steel reinforcement and reinforcement accessories.  
38 3. Admixtures.  
39 4. Curing compounds.  
40 5. Bonding agent or adhesive.  
41 6. Joint fillers.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 to conduct the testing indicated, as documented according to ASTM E548.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

## PART 2 PRODUCTS

## 2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves of a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

## 2.2 STEEL REINFORCEMENT

- A. Steel Welded Wire Fabric: ASTM A185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcement Bars: ASTM A615, Grade 60, deformed.
- C. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars, deformed.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

## 2.3 CONCRETE MATERIALS

- A. General: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I or II. Supplement with the following:

- a. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
  1. Class: 4S.
  2. Maximum Aggregate Size: 1 inch nominal.
  3. Do not use fine or coarse aggregates containing substances that cause spalling.
- D. Water: ASTM C 94.

#### 2.4 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

#### 2.5 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- B. Water: Potable.
- C. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

#### 2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, and non-redispersible, acrylic emulsion or styrene butadiene.

#### 2.7 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
  1. Do not use Owner's field quality-control testing agency as the independent testing agency.
- C. Proportion mixes to provide concrete with the following properties:

1. Compressive Strength (28 Days): 4,000 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 3 inches.
  - a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.

- D. Cementitious Materials: Provide composite mix of Portland Cement and Ground Granulated Blast-Furnace Slag or Blended Hydraulic Cement and reduce percentage, by weight, of Portland Cement (ASTM C150) relative to total cementitious material weight for each design mix to at least 40 percent less than standard regional concrete mix designs.

Limit percentage, by weight, of standard Portland cement (C-150), to the following maximum percentages of the cementitious portion of the mix while maintaining the above 40% required reduction in Portland cement across the project's total quantity of concrete:

1. Exterior Concrete – 65 percent except as noted in paragraph E below.

- E. Cementitious Materials for Exterior Concrete: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
5. Silica Fume: 10 percent.
6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent portland cement minimum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1.5 percent:

1. Air Content: 6.0 percent for 1-inch maximum aggregate.

## 2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

- B. Remove loose material from compacted subbase surface immediately before placing concrete.
- C. Preparation work, including finish grading (rough grade should be within 1/10 of finish grade), setting forms, and furnishing and installing of reinforcing steel shall also be done by the Contractor.

### 3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

### 3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Where indicated on plans install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

### 3.4 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
1. Install concrete joints in sidewalks at 5'-0" on center in both directions, unless otherwise indicated. Install perpendicular to curbs or building walls.
  2. Verify exact joint placement with the Architect prior to installation.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
1. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
  2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  3. Install construction joints at a maximum of 20'-0" on center.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
  2. Extend joint fillers full width and depth of joint.
  3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces. Provide 1/4-inch radius.

E. Edging: Tool edges of pavement, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces. Provide 1/4-inch radius.

### 3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

I. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

J. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.6 GENERAL CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic; at ramps and similar sloped surfaces.

### 3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturers written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.8 PAVEMENT TOLERANCES

#### A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot-long, unleveled straightedge not to exceed 1/4 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

### 3.9 FIELD QUALITY CONTROL

#### A. Testing Agency: Engage a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

#### B. Testing Services: Testing shall be performed according to the following requirements:

1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
5. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.



C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as the sole basis for approval or rejection.

E. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

### 3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

- B. Related Sections include the following:

1. Division 32 Section "Flexible Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

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

- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

- D. Qualification Data: For Installer.

- E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

### PART 2 - PRODUCTS

#### 1.7 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

- 1 B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2  
2 articles.

3 1.8 MATERIALS, GENERAL

- 4 A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible  
5 with one another and with joint substrates under conditions of service and application, as demonstrated by  
6 joint-sealant manufacturer based on testing and field experience.

- 7 B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

8 1.9 COLD-APPLIED JOINT SEALANTS

- 9 A. Multicomponent Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric  
10 formulation complying with the following requirements for formulation and with ASTM C 920 for type,  
11 grade, class, and uses indicated:

- 12 1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint  
13 substrates indicated, O.

- 14 a. Products:

- 15 1) Pecora Corporation; Urexpan NR-300.

- 16 B. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-  
17 tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T,  
18 M, and, as applicable to joint substrates indicated, O.

- 19 1. Products:

- 20 a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.

21 1.10 JOINT-SEALANT BACKER MATERIALS

- 22 A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates,  
23 sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant  
24 manufacturer based on field experience and laboratory testing.

- 25 B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required  
26 to control sealant depth and prevent bottom-side adhesion of sealant.

27 1.11 PRIMERS

- 28 A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to  
29 joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

## PART 2 - EXECUTION

## 2.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

## 2.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

## 2.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

1 F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless  
2 otherwise indicated.

3 G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

4 2.4 CLEANING

5 A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with  
6 cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

7 2.5 PROTECTION

8 A. Protect joint sealants during and after curing period from contact with contaminating substances and from  
9 damage resulting from construction operations or other causes so sealants are without deterioration or  
10 damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs,  
11 cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so  
12 installations with repaired areas are indistinguishable from the original work.

13 END OF SECTION 321373

1 SECTION 321713 - PARKING BUMPERS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Precast concrete wheel stops.

9 1.3 ACTION SUBMITTALS

- 10 A. Product Data:

- 11 1. Precast concrete wheel stops.

12 PART 2 - PRODUCTS

13 2.1 PARKING BUMPERS

- 14 A. Precast Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete; 4000-psi minimum  
15 compressive strength; 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered  
16 corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical  
17 holes through wheel stop for anchoring to substrate.

- 18  
19 1. Source Limitations: Obtain wheel stops from single source from single manufacturer.  
20 2. Surface Appearance: Smooth, free of pockets, sand streaks, honeycombs, and other obvious  
21 defects. Corners shall be uniform, straight, and sharp.  
22 3. Surface Sealer: Manufacturer's standard salt-resistant, clear sealer, applied at precasting location.  
23 4. Mounting Hardware: Galvanized-steel dowel, 1/2-inch diameter, 14-inch minimum length.  
24 5. Adhesive: Polyurethane or epoxy, as recommended in writing by wheel-stop manufacturer for  
25 adhesion to substrate.

26 PART 3 - EXECUTION

27 3.1 EXAMINATION

- 28 A. Verify that pavement is in suitable condition to begin installation in accordance with manufacturer's  
29 written instructions.

- 1        B.     Proceed with installation only after unsatisfactory conditions have been corrected.
- 2        3.2     INSTALLATION
- 3        A.     Install wheel stops in accordance with manufacturer's written instructions unless otherwise indicated.
- 4        B.     Securely anchor wheel stops to substrate with hardware in each preformed vertical hole in wheel stop as
- 5               recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.
- 6        END OF SECTION 321713



## SECTION 321723 - PAVEMENT MARKINGS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:

1. Painted markings applied to asphalt paving.
2. Painted markings applied to concrete surfaces.

- B. Related Requirements:

1. Section 071800 "Traffic Coatings" for painting whole areas of building floors and pavements with coatings having an integral wearing surface.
2. Section 099113 "Exterior Painting" for painting exterior concrete surfaces other than pavement markings.
3. Section 099123 "Interior Painting" for painting interior concrete surfaces other than pavement markings.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Coordination

1. Review methods and procedures related to marking asphalt paving or concrete surfaces including, but not limited to, the following:
  - a. Asphalt-paving or concrete-surface aging period before application of pavement markings.
  - b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

## 1.4 ACTION SUBMITTALS

- A. Product Data: Include technical data and tested physical and performance properties.

1. Pavement-marking paint, acrylic.
2. Glass beads.

- B. Shop Drawings:

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

## 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of PennDOT for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of **40 deg F for alkyd materials 55 deg for water-based materials**, and not exceeding **95 deg F**.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in **the USDOJ's "2010 ADA Standards for Accessible Design" and the ABA standards of the Federal agency having jurisdiction.**

## 2.3 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint, Alkyd: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, **Type F** colors complying with FS TT-P-1952F.

1. Color: **White, Yellow, Blue.**

- B. Pavement-Marking Paint, Acrylic: Acrylic, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952F, Type II, with drying time of less than 5 minutes.

1. Color: **White Yellow Blue.**

- C. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325D, Type 1.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.

- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

## 1 3.2 PAVEMENT MARKING

2 A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with  
3 Architect.4 B. Allow asphalt paving or concrete surfaces to age for a minimum of **30** days before starting pavement  
5 marking.

6 C. Sweep and clean surface to eliminate loose material and dust.

7 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt  
8 paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint  
9 application beyond stencil. Apply paint so that it cannot run beneath stencil.10 2. Broadcast glass beads uniformly into wet markings at a rate of **6 lb/gal.**

## 11 3.3 PROTECTING AND CLEANING

12 A. Protect pavement markings from damage and wear during remainder of construction period.

13 B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended  
14 by manufacturer of affected construction.

15 END OF SECTION 321723

1 SECTION 321726 - TACTILE WARNING SURFACING

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Cast-in-place detectable warning tiles.  
9 2. Surface-applied detectable warning tiles.  
10 3. Detectable warning mats.  
11 4. Detectable warning unit pavers.

- 12 B. Related Requirements:

- 13 1. Section 321313 "Concrete Paving" for concrete walkways serving as substrates for tactile warning  
14 surfacing.  
15 2. Section 321400 "Unit Paving" for unit paving installations incorporating detectable warning unit  
16 pavers specified in this Section.

17 1.3 ACTION SUBMITTALS

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

- 19 B. Samples for Initial Selection: For each type of exposed finish requiring color selection.

- 20 C. Samples for Verification: For each type of tactile warning surface, in manufacturer's standard sizes unless  
21 otherwise indicated, showing edge condition, truncated-dome pattern, texture, color, and cross section;  
22 with fasteners and anchors.

23 1.4 CLOSEOUT SUBMITTALS

- 24 A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

25 1.5 QUALITY ASSURANCE

26 1.6 PREINSTALLATION MEETINGS

- 27 A. Preinstallation Coordination

- 28 1. Coordinate type and placement with Project Architect

## 1.7 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Adhesive Application:
1. Apply adhesive only when ambient temperature is above **50 deg F** and when temperature has not been below **35 deg F** for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.
- C. Weather Limitations for Mortar and Grout:
1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of **100 deg F** and higher.
    - a. When ambient temperature exceeds **100 deg F**, or when wind velocity exceeds **8 mph** and ambient temperature exceeds **90 deg F**, set unit pavers within 1 minute of spreading setting-bed mortar.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering and wear.
    - b. Separation or delamination of materials and components.
  2. Warranty Period: 5 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 TACTILE WARNING SURFACING, GENERAL

- A. Accessibility Requirements: Comply with applicable provisions in **the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities** for tactile warning surfaces.
1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.
- B. Source Limitations: Obtain each type of tactile warning surfacing[, **joint material**] [, **setting material**] [, **anchor**] [, **and**] [**fastener**] from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

## 2.2 DETECTABLE WARNING TILES

- A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
1. Material: **Cast-fiber-reinforced polymer concrete tile**
  2. Color: **Red brick**
  3. Shapes and Sizes:
    - a. Rectangular panel, **12 by 12 inches or 24 by 24 inches**
    - b. Radius panel, nominal **24 inches** deep by **8-foot** outside radius.
  4. Dome Spacing and Configuration: **Manufacturer's standard compliant spacing with manufacturer's standard pattern.**
  5. Mounting:
    - a. Detectable warning tile set into formed recess in concrete and adhered with **mortar adhesive.**

## 2.3 DETECTABLE WARNING MATS

- A. Surface-Applied Detectable Warning Mats: Accessible truncated-dome detectable warning resilient mats, UV resistant, manufactured for adhering to existing concrete walkway surfaces, with slip-resistant surface treatment on domes, field of mat, and beveled outside edges.
1. Material: Modified rubber compound, UV resistant.
  2. Color: Red brick
  3. Shapes and Sizes:
    - a. Rectangular panel, **24 by 48 inches.**
  4. Dome Spacing and Configuration: **Manufacturer's standard compliant spacing, in manufacturer's standard pattern.**
  5. Mounting: Adhered to pavement surface with adhesive.

## 2.4 DETECTABLE WARNING UNIT PAVERS

- A. Detectable Warning Concrete Unit Pavers: Solid paving units, made from normal-weight concrete with a compressive strength of not less than **5000 psi**, water absorption of not more than 5 percent according to ASTM C 140, and no breakage and not more than 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67, with accessible detectable warning truncated domes on exposed surface of units.
1. Shapes and Sizes:
    - a. Thickness: **2 inches** at field of tile.
    - b. Face Size: Nominal **12 by 12 inches.**
  2. Dome Spacing and Configuration: **Manufacturer's standard compliant spacing, in manufacturer's standard pattern.**
  3. Color: Red Brick
- B. Mortar Setting Bed:
1. Portland Cement: ASTM C 150/C 150M, Type I or Type II.
  2. Sand: ASTM C 33/C 33M.

3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
4. Thinset Mortar: Latex-modified portland cement mortar complying with ANSI A118.4.
5. Water: Potable.

## 2.5 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:
  1. Furnish **Type 316** stainless-steel fasteners for exterior use.
  2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.
- B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.
- C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF TACTILE WARNING SURFACING

- A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
- B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

### 3.3 INSTALLATION OF DETECTABLE WARNING TILES

- A. Removable Cast-in-Place Detectable Warning Tiles:
  1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of removable tile.
  2. Set each detectable warning tile accurately and firmly in place with embedding anchors and fasteners attached, and firmly seat tile back in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
  3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus **1/8 inch (3 mm)** from flush.

4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
5. Clean tiles using methods recommended in writing by manufacturer.

B. Surface-Applied Detectable Warning Tiles:

1. Lay out detectable warning tiles as indicated and mark concrete pavement.
2. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.
3. Apply adhesive to back of tiles in amounts and pattern recommended by manufacturer, and set tiles in place. Firmly seat tiles in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
4. Install anchor devices through face of tiles and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with top surface of mat.
5. Mask perimeter of tiles and adjacent concrete, and apply sealant in continuous bead around perimeter of tile installation.
6. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning tiles and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.
7. Protect installed tiles from traffic until adhesive has set.

3.4 INSTALLATION OF DETECTABLE WARNING MATS

- A. Lay out detectable warning mats as indicated and mark concrete pavement at edges of mats.
- B. Prepare existing paving surface by grinding and cleaning as recommended by manufacturer.
- C. Apply adhesive to back of mat in amounts and pattern recommended by manufacturer, and set mat in place. Firmly seat mat in adhesive bed, eliminating air pockets and establishing full adhesion to pavement. If necessary, temporarily apply weight to mat to ensure full contact with adhesive.
- D. Install anchor devices through face of mat and into pavement using anchors located as recommended by manufacturer. Set heads of anchors flush with mat surface.
- E. Mask mat perimeter and adjacent concrete, and apply sealant in continuous bead around perimeter of mat.
- F. Remove masking, adhesive, excess sealant, and soil from exposed surfaces of detectable warning mat and surrounding concrete pavement using cleaning agents recommended in writing by manufacturer.
- G. Protect installed mat from traffic until adhesive has set.

3.5 INSTALLATION OF DETECTABLE WARNING UNIT PAVERS

A. Unit Paver Installation, General:

1. Setting-Bed and Unit Paver Installation: Comply with installation requirements in Section 321400 "Unit Paving."
2. Mix unit pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
3. Cut unit pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.



4. Tolerances: Do not exceed **1/4 inch in 10 feet (6 mm in 3 m)** from level, or indicated slope, for finished surface of paving.

B. Mortar Setting-Bed Applications:

1. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
2. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed **1/16-inch (1.6-mm)** thickness for bond coat.
3. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
4. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.
5. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform **1/16-inch- (1.5-mm-)** thick bond coat to mortar bed or to back of each paver with a flat trowel.
6. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
7. Spaced Joint Widths: Provide **3/8-inch** nominal joint width with variations not exceeding plus or minus **1/16 inch**.
8. Grouted Joints: Grout paver joints complying with ANSI A108.10. Grout joints as soon as possible after initial set of setting bed.
  - a. Force grout into joints, taking care not to smear grout on adjoining surfaces.
  - b. Tool exposed joints slightly concave when thumbprint hard.
  - c. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.
9. Remove excess grout from exposed paver surfaces; wash and scrub clean.
10. Protect installation from traffic until grout has set.

3.6 CLEANING AND PROTECTION

- A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.
- B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321726

1 SECTION 329200 – LAWNS, GRASSES AND EXTERIOR PLANTS

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes the following:

- 8 1. Seeding.  
9 2. Shrubs.  
10 3. Ground cover.

- 11 B. Related Sections include the following:

- 12 1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.  
13 2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.

14 1.3 DEFINITIONS

- 15 A. Finish Grade: Elevation of finished surface of planting soil.

- 16 B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with  
17 stabilized organic soil amendments to produce topsoil or planting soil.

- 18 C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become  
19 topsoil; mixed with soil amendments.

- 20 D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill  
21 or backfill immediately beneath planting soil.

- 22 E. Date of acceptance. Contractor shall contract Architect to schedule a final site walk through.

23 1.4 SUBMITTALS

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

- 25 B. Product Certificates for each material.

- 26 C. Qualification Data: For landscape Installer.

- 27 D. Planting Schedule: Indicating anticipated planting dates for each type of planting.

- E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns and exterior plantings during a calendar year. Submit before expiration of required maintenance period.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn and exterior plant establishment. Installer must be registered with the Pennsylvania Landscape and Nursery Association or similar agency and be in business for more than five years.

- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

- C. Topsoil Analysis: Furnish at a minimum four (4) soil samples, analyzed by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil. Soil tests must be taken and analysis results presented to Landscape Architect prior to any landscape work. Indicate on plan locations of sampling.

1. Report suitability of topsoil for lawn/plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

- B. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sunscald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

- C. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

- D. hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

#### 1.7 SCHEDULING

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: 3/15 – 5/15.  
2. Fall Planting: 9/15 – 11/15.

- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

## 1.8 LAWN MAINTENANCE

- A. Begin maintenance immediately after each area is planted and continue until the Landscape Architect has confirmed its acceptance. Following the Date of Acceptance, Contractor shall maintain lawn areas for a period of three months.
- B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.
1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water lawn at a minimum rate of 1 inch per week.
- D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the following grass height:
1. Mow grass 2-1/2 to 3 inches high.
- E. Lawn Post fertilization: Apply fertilizer after initial mowing and when grass is dry.
1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area or as directed by soil test.

## 1.9 EXTERIOR PLANT MAINTENANCE

- A. Trees and Shrubs: Maintain by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease.
- B. shrubs free of insects and disease.
- C. Ground Cover and Plants: Maintain by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings
- D. Time: Maintain all plantings for a period of three months from the date of acceptance.

## 1.10 WARRANTY

- A. The site contractor shall guarantee all plant material to be in healthy and flourishing condition for a period of eighteen (18) months from the date of acceptance. Any plant material found to be dying or in poor condition (i.e., dead main leader, 20% or greater branch die back) shall be removed and replaced immediately at no charge.

## 1 PART 2 - PRODUCTS

## 2 2.1 SEED

3 A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology;  
4 Rules for Testing Seeds" for purity and germination tolerances.

5 B. Seed Species: As indicated on plans.

## 6 2.2 EXTERIOR PLANTS

7 A. Tree and Shrub Material: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with  
8 healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched,  
9 healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries,  
10 abrasions, and disfigurement.

11 B. Root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy,  
12 vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries,  
13 abrasions, and disfigurement.

14 1. Provide balled and burlapped, container-grown trees and shrubs as indicated on plans.

15 2. All trees must have plant identification tags for identification from the nursery on each tree.

16 3. At a minimum, one shrub/groundcover of each species must be labeled from the nursery,  
17 certifying genus and species.

18 C. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar  
19 containers, and complying with ANSI Z60.1.

20 D. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown  
21 or listed.

## 22 2.3 TOPSOIL

23 A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of  
24 stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

25 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil  
26 to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other  
27 extraneous materials harmful to plant growth.

28 A. Supplement with imported or manufactured topsoil from off-site sources when quantities  
29 are insufficient. Obtain topsoil displaced from local, naturally well-drained construction or  
30 mining sites where topsoil occurs at least 6 inches deep; do not obtain from agricultural  
31 land, bogs or marshes.

## 32 2.4 INORGANIC SOIL AMENDMENTS

33 A. Lime: As recommended by the soil test report.

- 1 B. Sulfur: As recommended by the soil test report.
- 2 C. Iron Sulfate: As recommended by the soil test report.
- 3 D. Perlite: As recommended by the soil test report.
- 4 E. Agricultural Gypsum: As recommended by the soil test report.
- 5 F. Sand: As recommended by the soil test report.

6 2.5 ORGANIC SOIL AMENDMENTS

- 7 A. Leaf mould. Well decomposed, ground, weed free.

8 2.6 PLANTING ACCESSORIES

- 9 A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for  
10 application.

11 2.7 FERTILIZER

- 12 1. Use fertilizer indicated on plans or as recommended by soil test report.

13 2.8 MULCH

- 14 A. Double shredded hardwood mulch, uniform in size and free of foreign matter.

15 2.9 PLANTING SOIL MIX

- 16 A. Planting Soil Mix: Mix topsoil with the following soil amendments per recommendation of soil test.  
17 Plus mix ¼ leaf mould with topsoil.

18 2.10 GEOTEXTILE – WEED BARRIER

- 19 A. Geotextile: Woven from high UV, non-biodegradable polypropylene, resistant to sun, soil chemicals,  
20 mildew and insects. Product must exceed AASHTO-M-288, Class 1, stabilization standards. Suggested  
21 product: ProPex Woven Geotextile 2016 by Amoco Fabrics and Fibers Company of Austell, GA or  
22 approved equal.

23 PART 3 - EXECUTION

24 3.1 EXAMINATION

- 25 A. Examine areas to receive lawns and grass for compliance with requirements and other conditions  
26 affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

## 3.3 LAWN PREPARATION

- A. Limit lawn subgrade preparation to areas to be planted.
- B. Fine Grading: All fine grading shall be inspected and approved by the Landscape Architect prior to planting, mulching, sodding, or seeding. Site contractor shall clean topsoil of roots, plants, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth. Soil amendments as recommended by the soil sample test shall be tilled into the top 6" of topsoil.
- C. o the top 6" of topsoil.
- D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

## 3.4 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
  - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
- B. Sow seed at the rates indicated on plans.
- C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding and 1:3 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
  - 1. Protect seeded areas with slopes not exceeding 1:3 as indicated on plans.
- E. Protect seeded areas from hot, dry weather or drying winds by applying topsoil within 24 hours after completing seeding operations. Soak and scatter uniformly to a depth of 3/16 inch and roll to a smooth surface.

## 3.5 HYDROSEEDING

- A. Hydro seeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydro seed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
  - 1. Mix slurry with tackifier.
  - 2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch as indicated in soil test report.

## 3.6 SATISFACTORY LAWNS

- A. The Landscape Architect shall inspect all work for acceptance upon written request of the site contractor.
- B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

## 3.7 EXTERIOR PLANTING

## A. Bed Establishment:

1. Outline all proposed planting beds for approval by landscape architect 3 days prior to starting work.
2. Loosen subgrade of planting beds to depths and widths indicated on plans.
3. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
4. Amend topsoil as per soil test results and add ¼ leaf mould and mix thoroughly.

## B. Trees and Shrubs:

1. Stake/locate all trees and shrubs on site for approval by landscape architect 3 days prior to start of work.
2. Install plants as indicated on plans and by details.

## C. Ground Cover and Plant Planting:

1. Set out and space ground cover and plants as indicated.
2. Dig holes large enough to allow spreading of roots, and backfill with planting soil.
3. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
4. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
5. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

## D. Planting Bed Mulching:

1. Completely cover bed area with a minimum 4" cover of mulch.

## E. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

## F. Provide and maintain a water bag for each tree.

## G. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

## 3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.



- 1      B.      Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain
- 2                   barricades throughout maintenance period and remove after lawn is established.
- 3      C.      Remove erosion-control measures after grass establishment period.
- 4      D.      Instruct Owner's personnel in maintenance.
- 5      END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Tree stabilization.
3. Tree-watering devices.
4. Landscape edgings.
5. Tree grates.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 129200 "Interior Planters and Artificial Plants" for planters for live and artificial interior plants.
3. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.
4. Section 329600 "Transplanting" for transplanting non-nursery-grown trees.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than **[sizes indicated] [diameter and depth recommended by ANSI Z60.1 for type and size of plant required]**; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than **[sizes indicated] [diameter and depth recommended by ANSI Z60.1 for type and size of plant required]**.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container

shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

J. Planting Area: Areas to be planted.

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See [Section 329113 "Soil Preparation"] [Section 329115 "Soil Preparation (Performance Specification)"] for drawing designations for planting soils.

L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

#### 1.4 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

#### 1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
  - 1. Manufacturer's certified analysis of standard products.
  - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Sample Warranty: For special warranty.

## 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
  - 1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
  - 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
  - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
  - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements **6 inches** above the root flare for trees up to **4-inch** caliper size, and **12 inches** above the root flare for larger sizes.
  - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
  - 1. Notify Architect of sources of planting materials fourteen days in advance of delivery to site.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  3. Accompany each delivery of bulk materials with appropriate certificates.
- C. Deliver bare-root stock plants within **36 hours** of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.
- D. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at **60 to 65 deg F** until planting.
- G. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.
- H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- I. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
  2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
  3. Do not remove container-grown stock from containers before time of planting.
  4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

## 1.10 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 1 to May 30
2. Fall Planting: Sept 1 to December 15

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

## 1.11 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
- b. Structural failures including plantings falling or blowing over.
- c. Faulty performance of **tree stabilization**.
- d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of **Substantial Completion**.

- a. Trees, Shrubs, Vines, and Ornamental Grasses: **18** months.
- b. Ground Covers, Biennials, Perennials, and Other Plants: **12** months.
- c. Annuals: **Three** months.

3. Include the following remedial actions as a minimum:

- a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
- b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
- c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
- d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

## PART 2 - PRODUCTS

### 2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than **3/4 inch (19 mm)** in diameter; or with stem girdling roots are unacceptable.
  2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. **Annuals and Biennials:** Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

## 2.2 FERTILIZERS

- A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
1. Size: **5-gram** tablets.
  2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

## 2.3 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
1. Type: **Shredded hardwood.**
  2. Color: Natural.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a **1-inch** sieve; soluble-salt content of **2 to 5** dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
1. Organic Matter Content: **50 to 60** percent of dry weight.

## 2.4 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, **3 oz./sq. yd.** minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.
- B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, **4.8 oz./sq. yd.**

## 2.5 PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

## 2.6 TREE-STABILIZATION MATERIALS

## A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new **hardwood**, free of knots, holes, cross grain, and other defects, **2-by-2-inch nominal** by length indicated, pointed at one end.
2. Wood Deadmen: Timbers measuring **8 inches** in diameter and **48 inches** long, treated with specified wood pressure-preservative treatment.
3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes.
4. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, **0.106 inch** in diameter.
5. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
6. Flags: Standard surveyor's plastic flagging tape, white, **6 inches** long.

## B. Root-Ball Stabilization Materials:

1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, **2-by-2-inch nominal** by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.

## 2.7 LANDSCAPE EDGINGS

## A. Wood Edging: Of sizes indicated on Drawings, and wood stakes as follows:

1. Species: **Western red cedar, all heart.**
2. Stakes: Same species as edging, **1-by-2-inch nominal** by **18 inches** long, with galvanized nails for anchoring edging.

## B. Steel Edging: Standard commercial-steel edging, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

1. Edging Size: [**3/16 inch thick by 4 inches**] deep
2. Stakes: Tapered steel, a minimum of **12 inches** long.
3. Accessories: Standard tapered ends, corners, and splicers.
4. Finish: **Manufacturer's standard paint.**

- a. Paint Color: **Black**



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

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

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

### 3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to **Section 329113 "Soil Preparation."** Coordinate "Placing Planting Soil" Paragraph below with Section 329113 "Soil Preparation" or Section 329115 "Soil Preparation (Performance Specification)."

- B. Placing Planting Soil: **Place and mix planting soil in-place over exposed subgrade.**

- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### 3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that

- 1 root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared
- 2 or smoothed during excavation.
- 3 2. Excavate approximately three times as wide as ball diameter for **balled and burlapped** stock.
- 4 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of
- 5 the root ball.
- 6 4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and
- 7 thoroughly tamp the added soil to prevent settling.
- 8 5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of
- 9 adjacent paving, structures, hardscapes, or other new or existing improvements.
- 10 6. Maintain supervision of excavations during working hours.

11 B. Backfill Soil: Subsoil and topsoil removed from excavations **may** be used as backfill soil unless otherwise

12 indicated.

13 C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are

14 encountered in excavations.

15 D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or

16 shrub planting pits.

### 17 3.5 TREE, SHRUB, AND VINE PLANTING

18 A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If

19 root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges

20 from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

21 B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

22 C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root **2 inches**

23 **above** adjacent finish grades.

- 24 1. Backfill: Planting soil. **For trees, use excavated soil for backfill.**
- 25 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap,
- 26 rope, and wire baskets from tops of root balls and from sides, but do not remove from under root
- 27 balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or
- 28 broken before or during planting operation.
- 29 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets.
- 30 When planting pit is approximately one-half filled, water thoroughly before placing remainder of
- 31 backfill. Repeat watering until no more water is absorbed.
- 32 4. Place planting tablets equally distributed around each planting pit when pit is approximately one-
- 33 half filled. Place tablets beside the root ball about **1 inch** from root tips; do not place tablets in
- 34 bottom of the hole.

35 a. Quantity: **Two per plant.**

- 36 5. Continue backfilling process. Water again after placing and tamping final layer of soil.

37 D. **Balled and Potted and Container-Grown** Stock: Set each plant plumb and in center of planting pit or

38 trench with root flare **1 inch above** adjacent finish grades.

- 39 1. Backfill: Planting soil
- 40 2. Carefully remove root ball from container without damaging root ball or plant.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about **1 inch (25 mm)** from root tips; do not place tablets in bottom of the hole.

a. Quantity: **Two per plant.**

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

### 3.6 MECHANIZED TREE-SPADE PLANTING

A. Trees **[shall]** **[may]** be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. Use the same tree spade to excavate the planting hole as will be used to extract and transport the tree.

C. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

D. Cut exposed roots cleanly during transplanting operations.

E. Plant trees following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

### 3.7 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

### 3.8 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying:

- a. Stake trees of **2- through 5-inch** caliper. Stake trees of less than **2-inch** caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least **18 inches** below bottom of backfilled excavation and to **at least 72 inches** above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
  2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
  3. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
- B. Trunk Stabilization by Staking and Guying: Install trunk stabilization as follows unless otherwise indicated on Drawings. Stake and guy trees more than **14 feet** in height and more than **3 inches** in caliper unless otherwise indicated.

### 3.9 INSTALLATION OF ROOT BARRIER

- A. Install root barrier where trees are planted within **60 inches** of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.
- B. Align root barrier **vertically**, and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for a distance of **60 inches** in each direction from the tree trunk, for a total distance of **10 feet** per tree. If trees are spaced closer, use a single continuous piece of root barrier.
  1. Position top of root barrier **flush with finish grade**
  2. Overlap root barrier a minimum of **12 inches** at joints.
  3. Do not distort or bend root barrier during construction activities.
  4. Do not install root barrier surrounding the root ball of tree.

### 3.10 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines **as indicated on Drawings** in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

## 3.11 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of **12 inches** and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
1. Trees in Turf Areas: Apply **organic** mulch ring of **3-inch** average thickness, with **24-inch** radius around trunks or stems. Do not place mulch within **6 inches** of trunks or stems.
  2. Organic Mulch in Planting Areas: Apply **2-inch** average thickness of organic mulch **extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area**], and finish level with adjacent finish grades. Do not place mulch within **6 inches** of trunks or stems.

## 3.12 INSTALLATION OF EDGING

- A. Wood Edging: Install edging where indicated. Fasten each cut joint or connection with two galvanized nails. Anchor with wood stakes spaced up to **36 inches** apart, driven at least **1 inch** below top elevation of edging. Use two galvanized nails per stake to fasten edging, of length as needed to penetrate both edging and stake and provide **1/2-inch** clinch at point. Predrill stakes if needed to avoid splitting. Replace stakes that crack or split during installation process.
- B. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately **30 inches** apart, driven below top elevation of edging.

## 3.13 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

## 3.14 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

## 3.15 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than **25]** percent dead or in an unhealthy condition or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of **4 inches** or smaller in caliper size.

## 3.16 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before **[Substantial Completion]** <Insert time>, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

END OF SECTION 329300

1 SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

2 PART 1 - GENERAL

3 1.1 RELATED DOCUMENTS

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

6 1.2 SUMMARY

- 7 A. This Section includes the following:

- 8 1. Piping joining materials.  
9 2. Transition fittings.  
10 3. Dielectric fittings.  
11 4. Sleeves.  
12 5. Identification devices.  
13 6. Grout.  
14 7. Flowable fill.  
15 8. Piped utility demolition.  
16 9. Piping system common requirements.  
17 10. Equipment installation common requirements.  
18 11. Painting.  
19 12. Concrete bases.  
20 13. Metal supports and anchorages.

21 1.3 DEFINITIONS

- 22 A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather  
23 conditions.
- 24 B. Concealed Installations: Concealed from view and protected from weather conditions and physical  
25 contact by building occupants but subject to outdoor ambient temperatures. Examples include  
26 installations within unheated shelters.
- 27 C. ABS: Acrylonitrile-butadiene-styrene plastic.
- 28 D. CPVC: Chlorinated polyvinyl chloride plastic.
- 29 E. PE: Polyethylene plastic.
- 30 F. PVC: Polyvinyl chloride plastic.

31 1.4 ACTION SUBMITTALS

- 32 A. Product Data: For the following:
- 33 1. Dielectric fittings.

2. Identification devices.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.7 DELIVERY, STORAGE, AND HANDLING

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

- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

- a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.



- b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
  1. ABS Piping: ASTM D2235.
  2. CPVC Piping: ASTM F493.
  3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
  4. PVC to ABS Piping Transition: ASTM D3138.
- H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.2 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings NPS 1-1/2 and Smaller:
  1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
  2. Aboveground Piping: Specified piping system fitting.
- C. AWWA Transition Couplings NPS 2 and Larger:
  1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- D. Plastic-to-Metal Transition Fittings:
  1. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- E. Plastic-to-Metal Transition Unions:
  1. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint [or threaded] plastic end, rubber O-ring, and union nut.
- F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
  1. Description: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

## 2.3 SLEEVES

- A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

## 2.4 IDENTIFICATION DEVICES

- A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
- B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
  - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  - 2. Location: Accessible and visible.
- C. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- D. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.
- E. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- F. Lettering: Manufacturer's standard preprinted captions as selected by Architect.
- G. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
- H. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.
  - 1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
  - 2. Color: Comply with ASME A13.1, unless otherwise indicated.

- I. Valve Tags: Stamped or engraved with **1/4-inch** letters for piping system abbreviation and **1/2-inch** sequenced numbers. Include **5/32-inch** hole for fastener.
1. Material: **0.032-inch-** thick, **[polished brass]** **[or]** **[aluminum]**.
  2. Size: **1-1/2 inches** in diameter, unless otherwise indicated.
  3. Shape: As indicated for each piping system.
- J. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- K. Engraved Plastic-Laminate Signs: ASTM D709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
  2. Thickness: **1/16 inch**, unless otherwise indicated.
  3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- L. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
  2. Yellow: Heating equipment and components.
  3. Brown: Energy reclamation equipment and components.
  4. Blue: Equipment and components that do not meet criteria above.
  5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
  6. Terminology: Match schedules as closely as possible. Include the following:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  7. Size: **2-1/2 by 4 inches** for control devices, dampers, and valves; **4-1/2 by 6 inches** for equipment.
- M. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
1. Size: **3-1/4 by 5-5/8 inches**. Fasteners: Brass grommets and wire.
  2. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- N. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

## 2.5 GROUT

- A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

- 1           2.     Design Mix: **5000-psi**, 28-day compressive strength.
- 2           3.     Packaging: Premixed and factory packaged.

### 3     2.6     FLOWABLE FILL

- 4       A.     Description: Low-strength-concrete, flowable-slurry mix.

- 5           1.     Cement: ASTM C150, Type I, portland.
- 6           2.     Density: **115- to 145-lb/cu. ft.** .
- 7           3.     Aggregates: ASTM C33, natural sand, fine and crushed gravel or stone, coarse.
- 8           4.     Aggregates: ASTM C33, natural sand, fine.
- 9           5.     Admixture: ASTM C618, fly-ash mineral.
- 10          6.     Water: Comply with ASTM C94/C94M.
- 11          7.     Strength: **100 to 200 psig** at 28 days.

## 12    PART 3 - EXECUTION

### 13    3.1     PIPED UTILITY DEMOLITION

- 14       A.     Refer to Section 024119 "Selective Demolition" for general demolition requirements and procedures.

- 15       B.     Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

- 17           1.     Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- 18           2.     Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
- 19           3.     Equipment to Be Removed: Disconnect and cap services and remove equipment.
- 20           4.     Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
- 21           5.     Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- 26       C.     If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 28    3.2     DIELECTRIC FITTING APPLICATIONS

- 29       A.     Dry Piping Systems: Connect piping of dissimilar metals with the following:

- 30           1.     **NPS 2** and Smaller: Dielectric unions.
- 31           2.     **NPS 2-1/2 to NPS 12**; Dielectric flanges

- 32       B.     Wet Piping Systems: Connect piping of dissimilar metals with the following:

- 33           1.     **NPS** and Smaller: Dielectric **couplings or dielectric nipples**.
- 34           2.     **NPS 2-1/2 to NPS 4**: Dielectric nipples.
- 35           3.     **NPS 2-1/2 to NPS 8**: Dielectric nipples[ **or dielectric flange kits**].
- 36           4.     **NPS 10 and NPS 12**: Dielectric flange kits.

## 3.3 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
- I. Sleeves are not required for core-drilled holes.
- J. Permanent sleeves are not required for holes formed by removable PE sleeves.
- K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas **2 inches** above finished floor level.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    - a. Pipe Sleeves: For pipes smaller than **NPS 6**.
    - b. Steel Sheet Sleeves: For pipes **NPS 6** and larger, penetrating gypsum-board partitions.
- L. Verify final equipment locations for roughing-in.
- M. Refer to equipment specifications in other Sections for roughing-in requirements.

## 3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. Soldered Joints: Apply ASTM B813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.
- I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendixes.
  3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
  4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
  5. PVC Nonpressure Piping: Join according to ASTM D2855.
  6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.
- L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.
- M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.
- N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
1. Plain-End PE Pipe and Fittings: Use butt fusion.
  2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.5 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping **NPS 2** and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping **NPS 2-1/2** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

### 3.6 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

### 3.7 PAINTING

- A. Painting of piped utility systems, equipment, and components is specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.8 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  1. Stenciled Markers: According to ASME A13.1.
  2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
  3. Locate pipe markers on exposed piping according to the following:
    - a. Near each valve and control device.
    - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    - d. At manholes and similar access points that permit view of concealed piping.
    - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
  1. Lettering Size: Minimum **1/4 inch** high for name of unit if viewing distance is less than **24 inches**, **1/2 inch** high for distances up to **72 inches**, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
  2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

## 3.9 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

## 3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Section 055000 "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

## 3.11 GROUTING

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

## END OF SECTION 330500



1 SECTION 331100 - WATER DISTRIBUTION

2 PART 1 - GENERAL

3 1.1 SUMMARY

4 A. This Section includes water-distribution piping and specialties outside the building for the following:

5 1. Water services.

6 1.2 SUBMITTALS

7 A. Product Data: For the following:

8 1. Valves and accessories.

9 2. Backflow preventers and assemblies.

10 .

11 B. Operation and Maintenance Data: For the following:

12 1. Valves.

13 2. Backflow preventers.

14

15 1.3 QUALITY ASSURANCE

16 A. Regulatory Requirements:

17

18 1. Comply with standards of Aqua for potable-water-service piping, including materials, installation,  
19 testing, and disinfection.

20 B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

21 1.4 PROJECT CONDITIONS

22 A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless  
23 permitted under the following conditions and then only after arranging to provide temporary utility  
24 services according to requirements indicated:

25 1. Notify Engineer not less than two days in advance of proposed utility interruptions.

26 2. Do not proceed with utility interruptions without Engineer's written permission.

27 1.5 COORDINATION

28 A. Coordinate connection to existing service line with utility company as required.

29 PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

## 2.2 PIPE AND FITTINGS

A. Push-on-Joint, Ductile-Iron Pipe: Class 54 cement lined AWWA C151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated Per Water Authority specifications.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern per Authority Specifications.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

a. Gaskets: AWWA C111, rubber.

## 2.3 VALVES

A. AWWA, Cast-Iron, Gate Valves:

1. Per Water Authority Specifications:

Allowable suppliers:

- a. American Darling
- b. Kennedy
- c. Mueller
- d. Stockham
- e. U.S. Pipe
- f. Clow
- g. United States Pipe and Foundry Company

2. Nonrising-Stem, Metal-Seated Gate Valves: Per Water Authority Specifications - AWWA C500, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

- a. Minimum Working Pressure: 200 psig (1380 kPa).
- b. End Connections: Mechanical joint.
- c. Interior Coating: Complying with AWWA C550.

B. UL/FM, Cast-Iron Gate Valves:

1. Per Water Authority Specifications.

## 2.4 BACKFLOW-PREVENTION DEVICES

## A. Per Water Authority Specifications

## B. Double-Check-Valve Backflow Prevention Assemblies: Per Water Authority Specifications - AWWA C510, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Maximum Pressure Loss: **5 psig** through middle 1/3 of flow range.

## PART 3 - EXECUTION

## 3.1 PIPING APPLICATIONS

## A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

1. NPS 6 Use NPS 6 (DN 150) ductile-iron, push-on-joint pipe; and mechanical joint fitting per Water Authority Specifications.

## 3.2 VALVE APPLICATION

## A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts.

## 3.3 JOINT CONSTRUCTION

## A. Make pipe joints according to the following:

1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
2. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Utility Materials" for joining piping of dissimilar metals.

## 3.4 PIPING INSTALLATION

## A. Bury piping with depth of cover over top at least 42 inches with top at least 12 inches below level of maximum frost penetration.

## B. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

## 3.5 ANCHORAGE INSTALLATION

## A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.

2. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.6 VALVE INSTALLATION

- A. UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

### 3.7 WATER-METER INSTALLATION

- A. Water Authority will supply and install water meter. Contractor is coordinate with Water Authority for meter installation

- B. Rough-in piping and specialties for water-meter according to utility company's written instructions and requirements.

### 3.7 BACKFLOW-PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to Water Authority specifications.

- B. Do not install backflow preventers with relief drain in vault or other space subject to flooding.

- C. Do not install bypass piping around backflow preventers.

- D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers or in accordance with Water Authorities standards.

### 3.8 CONNECTIONS

- A. Install meter pit at location shown. Provide 6" DICL pipe and fittings to connect to the existing water line at locations shown.

### 3.9 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

- B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

- C. Prepare reports of testing activities.

### 3.10 IDENTIFICATION

- 1 A. Install continuous underground detectable warning tape during backfilling of trench for underground  
2 water-service piping. Locate below finished grade, directly over piping. See Division 2 Section  
3 "Earthwork" for underground warning tapes.

4 3.11 CLEANING

- 5 A. Clean and disinfect water-distribution piping as follows:

- 6 1. Purge new water-distribution piping systems and parts of existing systems that have been altered,  
7 extended, or repaired before use.  
8 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method  
9 is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for  
10 flushing of piping. Flush piping system with clean, potable water until dirty water does not appear  
11 at points of outlet.  
12 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method  
13 is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as  
14 described below:  
15 a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of  
16 chlorine; isolate and allow to stand for 24 hours.  
17 b. Drain system or part of system of previous solution and refill with water/chlorine solution  
18 containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.  
19 c. After standing time, flush system with clean, potable water until no chlorine remains in  
20 water coming from system.  
21 d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure  
22 if biological examination shows evidence of contamination.

- 23 B. Prepare reports of purging and disinfecting activities.

24 END OF SECTION 331100  
25  
26  
27  
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1 SECTION 333100 - SANITARY SEWERAGE

2 PART 1 - GENERAL

3 1.1 SUMMARY

- 4 A. This Section includes sanitary sewerage outside the building.

5 1.2 PERFORMANCE REQUIREMENTS

- 6 A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure but not less  
7 than 150 psig.

8 1.3 SUBMITTALS

- 9 A. Product Data: For the following:

- 10 1. Piping Material  
11 2. Backwater valves and cleanouts.

12 1.4 PROJECT CONDITIONS

- 13 A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

14 PART 2 - PRODUCTS

15 2.1 PIPING MATERIALS

16 2.2 PIPES AND FITTINGS

- 17 A. PVC Sewer Pipe and Fittings: According to the following:

- 18 1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, for solvent-  
19 cemented or gasketed joints.  
20 a. Gaskets: ASTM F 477, elastomeric seals.

21 2.3 MANHOLES

- 22 A. Normal-Traffic Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete,  
23 of depth indicated, with provision for rubber gasketed joints.  
24 2. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.

3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
5. Riser Sections: 4-inch (100-mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
7. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
8. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 229-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and cover.
9. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12- to 16-inch (300- to 400-mm) intervals. Omit steps for manholes less than 60 inches (1500 mm) deep.
10. Steps: ASTM C 478 (ASTM C 478M), individual steps or ladder. Omit steps for manholes less than 60 inches (1500 mm) deep.
11. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.

B. Manhole Frames and Covers: ASTM A536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch (610-mm) ID by 7- to 9-inch (178- to 229-mm) riser with 4-inch (100-mm) minimum width flange, and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering "SANITARY SEWER" cast into cover.

## 2.4 CONCRETE

B. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 3500 psi minimum, with 0.5 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.

C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: 2 percent through manhole.

## 2.5 PROTECTIVE COATINGS

B. Description: One- or two-coat, coal-tar epoxy; 15-mil (0.38-mm) minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:

1. Concrete Manholes: On exterior and interior surfaces.
2. Manhole Frames and Covers: On entire surfaces.

## 2.6 BACKWATER VALVES

- C. PVC Backwater Valves: Similar to ASME A112.14.1, horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

## 2.7 CLEANOUTS

- A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."
- B. Identification: Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
  1. Use detectable warning tape over nonferrous piping and over edges of underground structures.
- B. Piping Applications: Include watertight joints.
  1. NPS 4 to NPS 8 : PVC sewer pipe and fittings, gaskets, and gasketed joints.
- C. Sleeve-Type Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- D. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.
- E. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.
- F. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- G. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- H. Install gravity-flow piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
  1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.



2. Install piping with 36-inch minimum cover.
- I. Pipe Joint Construction and Installation: Join and install pipe and fittings according to installations indicated.
  1. PVC Sewer Pipe and Fittings: As follows:
    - d. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
    - e. Install according to ASTM D 2321.
  2. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.
- J. Concrete Placement: Place cast-in-place concrete according to ACI 318 and ACI 350R.
- K. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
- L. Set cleanout frames and covers in earth in cast-in-place concrete block, 12 by 12 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- M. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.
- N. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.
- O. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 12-inch overlap, with not less than 12 inches of concrete with 28-day compressive strength of 3000 psi .
- P. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 12 inches of concrete with 28-day compressive strength of 3000 psi.
- Q. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- R. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
  1. Place plug in end of incomplete piping at end of day and when work stops.
  2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

### 3.2 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
  1. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.

- b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  3. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems according to authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate reports for each test.
  5. If authorities having jurisdiction do not have published procedures, perform tests as follows:
    - a. Sanitary Sewerage: Perform hydrostatic test.
      - 1) Allowable leakage is maximum of 50 gal. per inch of nominal pipe size per mile of pipe, during 24-hour period.
      - 2) Close openings in system and fill with water.
      - 3) Purge air and refill with water.
      - 4) Disconnect water supply.
      - 5) Test and inspect joints for leaks.
      - 6) Option: Test ductile-iron piping according to AWWA C600, Section "Hydrostatic Testing." Use test pressure of at least 10 psig.
    - b. Sanitary Sewerage: Perform air test according to UNI-B-6.
  6. Manholes: Perform hydraulic test according to ASTM C 969.
  7. Leaks and loss in test pressure constitute defects that must be repaired.
  8. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 333100

SECTION 334100 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Extent of storm sewage systems work is indicated on drawings and by requirements of this section.
2. Include all piping, manholes, inlets, catch basins, etc. in conjunction with storm sewer work.

- B. Related Sections include the following:

1. Division 03 Section "Concrete Work for Utilities".
2. Division 31 "Earth Moving".
3. Division 31 Section "Excavation, Backfill and Compaction of Utilities".

1.3 QUALITY ASSURANCE

- A. Codes and Standards: All work shall be performed in accordance with methods and details indicated on the plans, local ordinances, Penn DOT Standard Form 408 latest edition as amended and all regulatory bodies having jurisdiction on this work.

- B. Environmental Compliance: Comply with applicable portions of respective County Conservation District regulations pertaining to storm sewage systems.

- C. Concrete Materials: Concrete materials, reinforcing, testing, etc. shall conform to Specification Section 033002 "Concrete Work for Utilities".

- D. American Society for Testing and Material (ASTM):

1. F677 Standard Specifications for Large Diameter Corrugated Polyethylene Pipe and Fitting.
2. C76 Reinforced Concrete Sewer Pipe and Fittings, Class III, Wall B for gasketed joints.
3. C443 Rubber Gaskets for Concrete Sewer Pipe

- E. AASHTO Specifications:

1. M294 Standard Specifications for Corrugated Polyethylene Pipe.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for all storm sewage system materials and products.

- 1 B. Shop Drawings: At project closeout, submit record drawings of installed storm sewage piping  
2 and products, in accordance with requirements of Division 1.
- 3 C. Maintenance Data: Submit maintenance data and parts list for storm sewage system materials  
4 and products. Include this data, product data, shop drawings, and record drawings in  
5 maintenance manual; in accordance with requirements of Division I.

6 PART 2 - PRODUCTS

7 2.1 CORRUGATED HIGH DENSITY POLYETHYLENE STORM SEWER PIPE

- 8 A. Material: All corrugated high-density polyethylene pipe shall have smooth interiors. All pipe  
9 shall be stamped with:
- 10 1. Name of manufacturer.  
11 2. Pipe size.  
12 3. AASHTO designation.
- 13 B. Connecting Band: Watertight sleeve type with O-ring gasket.
- 14 1. Manufacturers: Subject to compliance with requirements, provide products from one of  
15 the following:
- 16 a. Advanced Drainage Systems, Inc.
- 17 1) Pipe: ADS N 12.  
18 2) Connecting Band: ADS Pro Link WT Joint.

19 2.2 REINFORCED CONCRETE PIPE

- 20 A. Material: Round pipe shall be Class III reinforced concrete pipe, AASHTO designation MI70, in  
21 accordance with Section 601 respectively, Penn DOT Specifications, Form 408. Pipe joints  
22 shall be 'O'-ring rubber compression gasket joints conforming to ASTM C443. All reinforced concrete  
23 pipe shall be stamped with:
- 24 1. The name or trademark of the manufacturer.  
25 2. The pipe class, type of wall and size of pipe.  
26 3. The date of manufacture.
- 27 B. Joints: Tongue and groove gasket joint type complying with ASTM C443.
- 28 C. Mortar: Mortar for lift holes shall be composed of materials designated under the  
29 Cement Concrete specifications. Mortar shall be used within forty-five (45) minutes  
30 subsequent to mixing, and mortar that has stiffened shall not be remixed and used.

31 2.3 INLETS STRUCTURE

- 32 A. General: The Contractor shall provide precast inlets at the locations and to the dimensions and  
33 elevations shown on the plan. The inlets shall be the type inlets indicated on the drawings and  
34 constructed as specified by Penn DOT Standard Construction Details and as shown on the  
35 plans. Included shall be all necessary excavation, precast concrete sections, gaskets, brick  
36 masonry, frame and grate, concrete flow channels, backfilling and all necessary appurtenances for  
37 completion. Include all weep holes on inlets to provide sub-surface drainage under paved areas  
38 only.
- 39 B. Materials: Materials for the inlets shall conform to the following Penn DOT section of Form

408, latest edition, as amended.

1. Class A Concrete – Section 704.1. Concrete shall be air entrained.
2. Brick – Section 713.1.
3. Reinforcement – Section 709.1 and 709.3
4. Structural Steel – Section 1052.01 (Form 409).
5. Mortar – Section 705.7.
6. Brick Masonry – Section 663.2.
7. Precast Cement Concrete Units – Section 713.2.

C. Frame, Covers and Grates: Ductile-iron, heavy duty, as indicated on the plans.

1. Manufacturer: Vulcan Foundry, Neenah Foundry, Co., or approved equal.
2. Finish: Black asphaltum paint.

## 2.4 MANHOLES

A. Materials:

1. Precast Manholes: Conform to ASTM C 478 for "Specifications for Precast Reinforced Concrete Manhole Sections". Concrete shall be air-entrained. Form flow channels in bases.
2. Masonry Mortar: Conform to ASTM C-270.
3. Castings: Conform to ASTM A48, Class 30. Frames and covers shall be heavy duty AASHTO Highway Loading Class HS-20. Cover shall have word "STORM SEWER" inscripted with 2" high, raised letters and have 2 pick holes.
4. Manhole Steps: Extruded aluminum alloy as indicated.

## 2.5 CONCRETE WORK

A. Class AA Concrete:

1. 28-Day Compressive Strength: 3750 psi.
2. Slump: 1 to 3 inches.
3. Use for all precast concrete.

B. Class A Concrete:

1. 28-Day Compressive Strength: 3300 psi.
2. Slump: 1 to 3 inches.
3. Use for all site cast concrete.

C. Cement factor and maximum water cement ratio shall conform to Table A, Section 704.1 (b), Penn DOT 408 Specifications.

## PART 3 - EXECUTION

### 3.1 CONNECTION TO PUBLIC UTILITY

1. Install utilities in strict compliance with the Township requirements.

### 3.2 INSTALLATION

A. General: No pipe shall be laid on frozen or thawing material or during wet weather conditions. Each pipe shall be subject to observation by the Engineer, and those not meeting the specified requirements shall be removed from the work site. Delivery slips from the pipe suppliers shall be kept on the work site and furnished, upon request, to the Engineer. The Engineer shall have the right to make changes in the line and grade of all storm sewers as may be necessary or advantageous.

B. Lay pipe proceeding upgrade with the bell or groove pointing upstream.

C. Line and Grade Checks: The Contractor shall check each section of pipe from the string line and grade board or other approved methods. A variation of one quarter (1/4) inch or more from the true invert grade and a variation of one (1) inch or more from the true line will be sufficient reason for the Engineer to order the work to be rejected.

### 3.3 CORRUGATED POLYETHYLENE PIPE (PEP) AND REINFORCED CONCRETE PIPE (RCP) LAYING

A. All pipes shall be laid and maintained to the required lines and grades shown on the Contract Drawings.

B. Following the trench preparation, pipe laying shall proceed from the downgrade end. Pipe ends shall be carefully cleaned before pipes are lowered into the trench.

C. Each section of pipe shall be placed so that the full length of its barrel rests on six inches of bedding material. Each section of pipe shall be firmly held in position so that its invert forms a continuous grade with the invert of the previously laid pipe.

D. The end of the pipe shall be protected with a stopper to prevent the entrance of water, earth stones, or other debris. Any debris entering the pipe shall be removed immediately to the satisfaction of the Engineer.

E. Walking or working on the completed pipeline, except as may be necessary in tamping or backfilling, shall not be permitted until the trench has been backfilled to a height of at least eighteen inches over the top of the pipes.

F. Store sewer pipe that has its grade or joints disturbed after laying shall be taken up and re-laid. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe by the Contractor.

G. Joints in corrugated polyethylene pipe shall be made with specified couplings.

H. Joints in reinforced concrete pipe shall be made with gasket type jointing material.

### 3.4 INLET AND OUTLET STRUCTURES AND MANHOLES

A. Inlets shall conform to the lines and grades given, and to the dimensions and design as indicated on the drawings.

B. Inlet and outlet structures shall be constructed using precast units. All reinforcing shall conform to Penn DOT Standard Construction Details as indicated on the drawings.

C. Cement concrete construction shall comply with the applicable requirements of Section 713, Form 408 and be air-entrained concrete.

D. Masonry construction shall comply with the applicable requirements of Section 713, Form 408.

- 1 E. Inlets shall be constructed in accordance with the requirements specified for the class of  
2 concrete or type of masonry for the work as required. Concrete foundations and walls shall be  
3 placed monolithically; except when permitted by the Engineer, they may be constructed  
4 separately if the Contractor places #4 steel reinforcement bars, at least 23 inches in length and  
5 spaced 8 inches center-to-center, as dowels between the foundation and walls placed thereon, at no  
6 expense to the Owner.
- 7 F. The pipe in inlets shall be flush with the inside face of the structure.
- 8 G. Spaces excavated for but not occupied by these structures, shall be backfilled with acceptable  
9 material in uniform loose layers not exceeding four (4) inches in depth, and be compacted by  
10 means of approved mechanical tampers.
- 11 END OF SECTION 334100

## 1 SECTION 334600 - SUBDRAINAGE

## 2 PART 1 - GENERAL

## 3 1.1 RELATED DOCUMENTS

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

## 6 1.2 SUMMARY

- 7 A. Section Includes:

- 8 1. Perforated-wall pipe and fittings.  
9 2. Drainage conduits.  
10 3. Drainage panels.  
11 4. Geotextile filter fabrics.

## 12 1.3 ACTION SUBMITTALS

- 13 A. Product Data:

- 14 1. Drainage conduits, including rated capacities.  
15 2. Drainage panels, including rated capacities.  
16 3. Geotextile filter fabrics.

## 17 PART 2 - PRODUCTS

## 18 2.1 PERFORATED-WALL PIPES AND FITTINGS

- 19 A. Perforated PE Pipe and Fittings:

- 20 1. **NPS 6** and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.  
21 2. **NPS 8** and Larger: ASTM F667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP;  
22 corrugated; for coupled joints.  
23 3. Couplings: Manufacturer's standard, band type.

- 24 B. Perforated PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

## 25 2.2 DRAINAGE CONDUITS

- 26 A. Molded-Sheet Drainage Conduits: Prefabricated geocomposite with cusped, molded-plastic drainage  
27 core wrapped in geotextile filter fabric.

- 28 1. Nominal Size: **12 inches** high by approximately **1 inch** thick.

- 29 a. Minimum In-Plane Flow: **30 gpm** at hydraulic gradient of **1.0** when tested according to  
30 ASTM D4716.



2. Filter Fabric: PP geotextile.
  3. Fittings: HDPE with combination **NPS 4 and NPS 6** outlet connection.
- B. Multipipe Drainage Conduits: Prefabricated geocomposite with interconnected, corrugated, perforated-pipe core molded from HDPE complying with ASTM D1248 and wrapped in geotextile filter fabric.
1. Nominal Size: **6 inches** high by approximately **1-1/4 inches** thick.
    - a. Minimum In-Plane Flow: **15 gpm** at hydraulic gradient of **1.0** when tested according to ASTM D4716.
  2. Filter Fabric: Nonwoven, needle-punched geotextile.
  3. Fittings: HDPE with combination **NPS 4 and NPS 6** outlet connection.
  4. Couplings: HDPE.
- C. Single-Pipe Drainage Conduits: Prefabricated geocomposite with perforated corrugated core molded from HDPE complying with ASTM D3350 and wrapped in geotextile filter fabric.
1. Nominal Size: **12 inches** high by approximately **1 inch** thick.
    - a. Minimum In-Plane Flow: **30 gpm** at hydraulic gradient of **1.0** when tested according to ASTM D4716.
  2. Filter Fabric: PP geotextile.
  3. Fittings: HDPE with combination **NPS 4 and NPS 6 (DN 100 and DN 150)** outlet connection.
  4. Couplings: Corrugated HDPE band.
- D. Mesh Fabric Drainage Conduits: Prefabricated geocomposite with plastic-filament drainage core wrapped in geotextile filter fabric. Include fittings for bends and connection to drainage piping.
- 1.
  2. Nominal Size: **6 inches** high by approximately **0.9 inch** thick.
    - a. Minimum In-Plane Flow: **2.4 gpm** at hydraulic gradient of **1.0** when tested according to ASTM D4716.
  3. Filter Fabric: Nonwoven geotextile made of PP or polyester fibers or combination of both. Flow rates range from **120 to 200 gpm/sq. ft.** when tested according to ASTM D4491.
- E. Ring Fabric Drainage Conduits: Drainage conduit with HDPE rings-in-grid pattern drainage core, for field-applied geotextile filter fabric. Include fittings for bends and connection to drainage piping.
1. Nominal Size: **18 inches** high by **1 inch** thick.
    - a. Minimum In-Plane Flow: **82 gpm** at hydraulic gradient of **1.0** when tested according to ASTM D4716.
  2. Filter Fabric: Comply with requirements for flat geotextile filter fabric specified in Part 2 "Geotextile Filter Fabrics" Article.

## 2.3 DRAINAGE PANELS

- A. Molded-Sheet Drainage Panels: Prefabricated geocomposite, **36 to 60 inches** wide with drainage core faced with geotextile filter fabric.
1. Drainage Core: Three-dimensional, nonbiodegradable, molded PP.

- a. Minimum Compressive Strength: **10,000 lbf/sq.ft.** when tested according to ASTM D1621.
    - b. Minimum In-Plane Flow Rate: **2.8 gpm/ft.** (of unit width at hydraulic gradient of **1.0** and compressive stress of **25 psig** when tested according to ASTM D4716.
  2. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288:
    - a. Survivability: **Class 2**
    - b. Apparent Opening Size: **No. 40** sieve, maximum.
    - c. Permittivity: **0.2** per second, minimum.
  3. Filter Fabric: Woven geotextile fabric, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation less than 50 percent; complying with the following properties determined according to AASHTO M 288:
    - a. Survivability: **Class 2.**
    - b. Apparent Opening Size: **No. 40** sieve, maximum.
    - c. Permittivity: **0.2** per second, minimum.
  4. Film Backing: Polymeric film bonded to drainage core surface.
  - B. Mesh Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.
    1. Drainage Core: Open-construction, resilient, plastic-filament mesh, approximately **0.4 inches (10.2 mm)** thick.
      - a. Minimum In-Plane Flow Rate: **2.4 gpm/ft.** of unit width at hydraulic gradient of **1.0** and normal pressure of **25 psig** when tested according to ASTM D4716.
    2. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from **120 to 200 gpm/sq. ft.** when tested according to ASTM D4491.
  - C. Net Fabric Drainage Panels: Prefabricated geocomposite with drainage core faced with geotextile filter fabric.
    1. Drainage Core: Three-dimensional, PE nonwoven-strand geonet, approximately **0.25 inches (6 mm)** thick.
      - a. Minimum In-Plane Flow Rate: **2.4 gpm/ft.** of unit width at hydraulic gradient of **1.0** and normal pressure of **25 psig** when tested according to ASTM D4716.
    2. Filter Fabric: Nonwoven geotextile of PP or polyester fibers or combination of both. Flow rates range from **120 to 200 gpm/sq. ft** when tested according to ASTM D4491.
  - D. Ring Fabric Drainage Panels: Drainage-core panel for field application of geotextile filter fabric.
- See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain one of first two subparagraphs and list of manufacturers below. See Section 016000 "Product Requirements."
- Retain option in first subparagraph below if manufacturer's name and model number are indicated in schedules or plans on Drawings; delete option and insert manufacturer's name and model number if not included on Drawings.
1. Drainage Core: Three-dimensional, HDPE rings-in-grid pattern, approximately **1 inch** thick.
    - a. Minimum In-Plane Flow Rate: **40 gpm/ft.** of unit width at hydraulic gradient of **1.0** <Insert value> and normal pressure of **25 psig** when tested according to ASTM D4716.

## 2.4 SOIL MATERIALS

- A. Soil materials are specified in Section 312000 "Earth Moving."

## 2.5 WATERPROOFING FELTS

- A. Material: Comply with **ASTM D226, Type I, asphalt**-saturated organic felt.

## 2.6 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from **110 to 330 gpm/sq. ft.** when tested according to ASTM D4491.
- B. Structure Type: Nonwoven, needle-punched continuous filament.
1. Survivability: AASHTO **M 288 Class 2**.
2. Styles: Flat and sock.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.
- C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

## 3.3 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than **6 inches mm)** deep and **12 inches** wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than **4 inches**.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with **adhesive or tape**.

- 1 E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.
- 2 F. Add drainage course to width of at least **6 inches** on side away from wall and to top of pipe to perform  
3 tests.
- 4 G. After satisfactory testing, cover drainage piping to width of at least **6 inches** on side away from footing  
5 and above top of pipe to within **12 inches** of finish grade.
- 6 H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- 7 I. Place layer of **[flat-style geotextile filter fabric] [waterproofing felt]** over top of drainage course,  
8 overlapping edges at least **4 inches**.
- 9 J. Install drainage panels on foundation walls as follows:
- 10 1. Coordinate placement with other drainage materials.
- 11 2. Lay perforated drainage pipe at base of footing. Install as indicated in Part 3 "Piping Installation"  
12 Article.
- 13 3. Separate **4 inches** of fabric at beginning of roll and cut away **4 inches** of core. Wrap fabric around  
14 end of remaining core.
- 15 4. Attach panels to wall beginning at subdrainage pipe. Place and secure molded-sheet drainage  
16 panels, with geotextile facing away from wall.
- 17 K. Place backfill material over compacted drainage course. Place material in loose-depth layers not  
18 exceeding **6 inches**. Thoroughly compact each layer. Final backfill to finish elevations and slope away  
19 from building.

#### 20 3.4 UNDERSLAB DRAINAGE INSTALLATION

- 21 A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage  
22 course has been placed. Include horizontal distance of at least **6 inches (150 mm)** between drainage pipe  
23 and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed  
24 for drainage system.
- 25 B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- 26 C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to  
27 compacted depth of not less than **4 inches**.
- 28 D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with  
29 **[adhesive] [or] [tape]**.
- 30 E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.
- 31 F. Add drainage course to width of at least **6 inches** on side away from wall and to top of pipe to perform  
32 tests.
- 33 G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and  
34 compact and wrap top of drainage course with flat-style geotextile filter fabric.
- 35 H. Install horizontal drainage panels as follows:
- 36 1. Coordinate placement with other drainage materials.
- 37 2. Lay perforated drainage pipe at inside edge of footing.

3. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.
4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.

### 3.5 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
  - B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than **4 inches**.
  - C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with **adhesive or tape**.
  - D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.
  - E. Add drainage course to width of at least **6 inches** on side away from wall and to top of pipe to perform tests.
  - F. After satisfactory testing, cover drainage piping to width of at least **6 inches** on side away from footing and above top of pipe to within **12 inches** of finish grade.
  - G. Place drainage course in layers not exceeding **3 inches** in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
  - H. Place layer of **[flat-style geotextile filter fabric] [waterproofing felt]** over top of drainage course, overlapping edges at least **4 inches**.
  - I. Install drainage panels on wall as follows:
    1. Coordinate placement with other drainage materials.
    2. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
    3. Mark horizontal chalk line on wall at a point **6 inches** less than panel width above footing bottom. Before marking wall, subtract footing width.
    4. Separate **4 inches** of fabric at beginning of roll and cut away **4 inches** of core. Wrap fabric around end of remaining core.
- Retain first subparagraph below if pipe is used.**
5. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from **2 to 6 inches** (below top of panel, approximately **48 inches** apart. **[Construction adhesives, metal stick pins, or double-sided tape may be used instead of nails.]** Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
  6. If another panel is required on same row, cut away **4 inches** of installed panel core and wrap fabric over new panel.
  7. If additional rows of panel are required, overlap lower panel with **4 inches** of fabric.
  8. Cut panel as necessary to keep top **12 inches** below finish grade.
  9. For inside corners, bend panel. For outside corners, cut core to provide **3 inches** for overlap.
- J. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding **6 inches**. Thoroughly compact each layer. Fill to finish grade.

## 3.6 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than **4 inches**.
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least **6 inches** between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with **adhesive or tape**.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within **12 inches** of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of **[flat-style geotextile filter fabric] [waterproofing felt]** over top of drainage course, overlapping edges at least **4 inches**.
- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding **6 inches**. Thoroughly compact each layer. Fill to finish grade.

## 3.7 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
  - 1. Foundation Subdrainage: Install piping level and with a minimum cover of **30** unless otherwise indicated.
  - 2. Underslab Subdrainage: Install piping level.
  - 3. Plaza Deck Subdrainage: Install piping level.
  - 4. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of **30 inches** unless otherwise indicated.
  - 5. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of **0.5** percent and with a minimum cover of **30 inches** unless otherwise indicated.
  - 6. Lay perforated pipe with perforations down.
  - 7. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install thermoplastic piping according to ASTM D2321.

## 3.8 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings according to ASTM D3212 with loose banded, coupled, or push-on joints.
- B. Join perforated PVC sewer pipe and fittings according to ASTM D3212 with loose bell-and-spigot, push-on joints.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

## 3.9 BACKWATER VALVE INSTALLATION

- A. Comply with requirements for backwater valves specified in Section 334100 "Storm Utility Drainage Piping."
- B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.
- C. Install horizontal backwater valves in piping where indicated.

## 3.10 CLEANOUT INSTALLATION

- A. Comply with requirements for cleanouts specified in Section 334100 "Storm Utility Drainage Piping."
- B. Cleanouts for **Foundation Retaining-Wall and Landscaping** ] Subdrainage:
  - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
  - 2. In vehicular-traffic areas, use **NPS 4** cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, **18 by 18 by 12 inches** deep. Set top of cleanout flush with grade.
  - 3. In nonvehicular-traffic areas, use **NPS 4** pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, **12 by 12 by 4 inches** deep. Set top of cleanout **2 inches** above grade.
  - 4. Comply with requirements for concrete specified in Section 033000 "Cast-in-Place Concrete."
- C. Cleanouts for Underslab Subdrainage:
  - 1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
  - 2. Use **NPS 4** cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

## 3.11 CONNECTIONS

- A. Comply with requirements for piping specified in Section 334100 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to solid-wall-piping storm drainage system.

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- 2 C. Where required, connect low elevations of **foundation** subdrainage to stormwater sump pumps. Comply  
3 with requirements for sump pumps specified in Section 221429 "Sump Pumps."

4 3.12 IDENTIFICATION

- 5 A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for  
6 underground warning tapes specified in specified in Section 312000 "Earth Moving."

- 7 1. Install PE warning tape or detectable warning tape over ferrous piping.  
8 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

9 3.13 FIELD QUALITY CONTROL

- 10 A. Tests and Inspections:

- 11 1. After installing drainage course to top of piping, test drain piping with water to ensure free flow  
12 before backfilling.  
13 2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

- 14 B. Drain piping will be considered defective if it does not pass tests and inspections.

- 15 C. Prepare test and inspection reports.

16 3.14 CLEANING

- 17 A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses.  
18 Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of  
19 uncompleted pipe at end of each day or when work stops.

20 END OF SECTION 334600