

CANNONDESIGN

Webster University
Interdisciplinary Science Building
St. Louis, Missouri

PROJECT MANUAL

Volume 1
Division 00-14

July 15, 2016

Conformed Set

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SECTION 000110 - TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
000110	Table of Contents	Cannon	X	X	X
003132.1	Subsurface Drilling and Sampling Report	Cannon	X		
003132.2	Soils Report	Akins	X		
007113	General Conditions of the Contract for Construction	Cannon	X		
007300	Supplementary Conditions	Cannon	X		

SPECIFICATIONS GROUP

General Requirements Subgroup

DIVISION 01 – GENERAL REQUIREMENTS

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
012200	Unit Prices	Cannon	X		
012900	Payment Procedures	Cannon	X		
013100	Project Management and Coordination	Cannon	X		
013100.1	RFI Form	Cannon	X		
013200	Construction Progress Documentation	Cannon	X		
013233	Photographic Documentation	Cannon	X		
013300	Submittal Procedures	Cannon	X		
013300.1	Submittal ID Sheet	Cannon	X		
013300.2	Contractor's Certification Letter	Cannon	X		
014000	Quality Requirements	Cannon	X		
014200	References	Cannon	X		
015000	Temporary Facilities and Controls	Cannon	X		
015639	Temporary Tree and Plant Protection	SWT	X		X
016000	Product Requirements	Cannon	X		
016000.0	Substitution Request Form	Cannon	X		
017300	Execution	Cannon	X		
017329	Cutting and Patching	Cannon	X		
017419	Construction Waste Management and Disposal	Cannon	X		
017419.1	Form CWM-1	Cannon	X		
017419.3	Form CWM-3	Cannon	X		
017419.5	Form CWM-5	Cannon	X		
017419.7	Form CWM-7	Cannon	X		
017700	Closeout Procedures	Cannon	X		
017823	Operation and Maintenance Data	Cannon	X		
017839	Project Record Documents	Cannon	X		
017900	Demonstration and Training	Cannon	X		

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018113.13	Sustainable Design Requirements – LEED 2009-New Construction and Major Renovations	Cannon	X		
019113	General Commissioning Requirements	R&B		X	

Facility Construction Subgroup

DIVISION 02 – EXISTING CONDITIONS

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
024119	Selective Structure Demolition	Cannon	X		

DIVISION 03 – CONCRETE

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
033000	Cast In Place Concrete	DMA	X		
033500	Concrete Finishing	Cannon			X

DIVISION 04 – MASONRY

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
042000	Unit Masonry	Cannon	X		X
044300	Anchored Stone Masonry Veneer	Cannon	X		

DIVISION 05 – METALS

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
051200	Structural Steel Framing	DMA	X		
053100	Steel Decking	DMA	X		
054000	Cold Formed Metal Framing	Cannon	X		
054523	Laboratory Metal Supports	Cannon			X
055000	Metal Fabrications	Cannon	X		
055113	Metal Pan Stairs	Cannon			X
055213	Pipe and Tube Railings	Cannon			X
057100	Decorative Metal Stairs	Cannon			X
057300	Decorative Metal Railings	Cannon	X		
057313	Glazed Decorative Metal Railings	Cannon			X
057500	Decorative Formed Metal	Cannon			X

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
061053	Miscellaneous Rough Carpentry	Cannon			X
061600	Sheathing	Cannon	X		

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064113	Wood-Venner-Faced Architectural Cabinets	Cannon			X
064116	Plastic-Laminate-Faced Architectural Cabinets	Cannon			X
064216	Flush Wood Paneling	Cannon			X
064600	Wood Trim	Cannon			X
066400	Plastic Paneling	Cannon			X

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
071113	Bituminous Damproofing	Cannon	X		
071326	Self-Adhering Sheet Waterproofing	Cannon	X		
071413	Hot Fluid-Applied Rubberized Asphalt Waterproofing	Cannon	X		
072100	Thermal Insulation	Cannon	X		
072600	Under Slab Vapor Barrier	Cannon	X		
072726	Fluid Applied Membrane Air Barriers	Cannon	X		
074243	Metal Composite Material Wall Panels	Cannon	X		
074646	Fiber-Cement Siding	Cannon	X		
074800	Cladding Support Systems	Cannon	X		
075323	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	Cannon	X		
076200	Sheet Metal Flashing and Trim	Cannon	X		
077100	Roof Specialties	Cannon	X		
077200	Roof Accessories	Cannon	X		
078100	Applied Fireproofing	Cannon			X
078413	Penetration Firestopping	Cannon			X
078446	Fire-Resistive Joint Systems	Cannon			X
079100	Preformed Joint Seals	Cannon			X
079200	Joint Sealants	Cannon			X
079500	Expansion Control	Cannon			X

DIVISION 08 - OPENINGS

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
081113	Hollow Metal Doors and Frames	Cannon			X
081216	Aluminum Frames	Cannon			X
081416	Flush Wood Doors	Cannon			X
083113	Access Doors and Frames	Cannon			X
083333	Side Coiling Doors	Cannon			X
084123	Fire Rated Glass and Framing Systems	Cannon			X
084423	Structural-Sealant-Glazed Curtain Walls	Cannon	X		
087100.01	Storefront Door Hardware	Cannon	X		
087100.03	Door Hardware	Cannon			X
088000	Glazing	Cannon	X		X
088300	Mirrors	Cannon			X
089119	Fixed Louvers	Cannon	X		

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DIVISION 09 - FINISHES

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
090500	Floor Preparation	Cannon			X
092116	Gypsum Board Shaft Wall Assemblies	Cannon			X
092216	Non-Structural Metal Framing	Cannon			X
092713	Glass-Fiber-Reinforced Plaster Fabrications	Cannon			X
092900	Gypsum Board	Cannon			X
093013	Ceramic Tiling	Cannon			X
095113	Acoustical Panel Ceilings	Cannon			X
095426	Linear Wood Ceilings	Cannon			X
096229	Cork Flooring	Cannon			X
096400	Wood Flooring	Cannon			X
096513	Resilient Base and Accessories	Cannon			X
096516	Resilient Sheet Flooring	Cannon			X
096519	Resilient Tile Flooring	Cannon			X
096623	Resinous Matrix Terrazzo Flooring	Cannon			X
096723	Resinous Flooring	Cannon			X
096813	Tile Carpeting	Cannon			X
096816	Sheet Carpeting	Cannon			X
097200	Wall Coverings	Cannon			X
097610	Concrete Sealer	Cannon			X
097713	Stretched-Fabric Wall Systems	Cannon			X
098310	Acoustical Plaster Surfacing	Cannon			X
098413	Fixed Sound-Absorbive Wood Panels	Cannon			X
098433	Sound-Absorbing Wall Units	Cannon			X
098453	Partition Closure	Cannon			X
099113	Exterior Painting	Cannon			X
099123	Interior Painting	Cannon			X
099230	Special Wall Coatings	Cannon			X
099714	Thermal-Break Coating for Steel	Cannon	X		
099737	Dry Erase Coatings	Cannon			X

DIVISION 10 - SPECIALTIES

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
101146	Visual Display Fabrics	Cannon			X
101400	Signage	KLI			X
102113.19	Plastic Toilet Compartments	Cannon			X
102800	Toilet, Bath and Laundry Accessories	Cannon			X
104313	Defibrillator Cabinets	Cannon			X
104413	Fire Protection Cabinets	Cannon			X
104416	Fire Extinguishers	Cannon			X
105210	Cylinder Bracket Support	Cannon			X

DIVISION 11 – EQUIPMENT

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
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110140	Building Maintenance Equipment	Cannon	X		
111319	Stationary Loading Dock Equipment	Cannon	X		
113100	Residential Appliances	Cannon			X
114000	Foodservice Equipment	FFC		X	
115213	Projection Screens	Cannon			X
115300	Laboratory Equipment	Cannon			X
115313	Laboratory Fume Hoods	Cannon			X

DIVISION 12 – FURNISHINGS

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
122200	Curtains and Drapes	Cannon			X
122413	Roller Window Shades	Cannon			X
123553	Laboratory Casework	Cannon			X
123623.13	Plastic Laminate Clad Countertops	Cannon			X
123661.16	Solid Surfacing Countertops	Cannon			X
123661.19	Quartz Agglomerate Countertops	Cannon			X
126100	Fixed Audience Seating	Cannon			X
129300	Site Furnishings	SWT			X

DIVISION 13 – SPECIAL CONSTRUCTION

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
130383	Controlled Temperature Rooms	Cannon			X

DIVISION 14 – CONVEYING EQUIPMENT

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
142100	Electric Traction Elevators	Cannon		X	X

DIVISION 21 – FIRE SUPPRESSION

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
210517	Sleeves and Sleeve Seals for Fire-Suppression Piping	Webb		X	
210518	Escutcheons for Fire-Suppression Piping	Webb		X	
210523	General-Duty Valves for Water-Based Fire-Suppression Piping	Webb		X	
210548	Vibration and Seismic Controls for Fire-Suppression Piping and Equipment	Webb		X	
210553	Identification for Fire-Suppression Piping and Equipment	Webb		X	
211119	Fire-Department Connections	Webb		X	
211200	Fire-Suppression Standpipes	Webb		X	
211313	Wet-Pipe Sprinkler System	Webb		X	
211316	Dry-Pipe Sprinkler System	Webb		X	

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213113	Electric-Drive, Centrifugal Pumps	Webb		X	
213400	Pressure-Maintenance Pumps	Webb		X	
213900	Controllers for Fire-Pump Drivers	Webb		X	

DIVISION 22 – PLUMBING

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
220513	Common Motor Requirements for Plumbing Equipment	Webb		X	
220517	Sleeves and Sleeve Seals for Plumbing Piping	Webb		X	
220518	Escutcheons for Plumbing Piping	Webb		X	
220519	Meters and Gages for Plumbing Piping	Webb		X	
220523.12	Ball Valves for Plumbing Piping	Webb		X	
220523.14	Check Valves for Plumbing Piping	Webb		X	
220529	Hangers and Supports for Plumbing Piping and Equipment	Webb		X	
220548	Vibration and Seismic Controls for Plumbing Piping and Equipment	Webb		X	
220553	Identification for Plumbing Piping and Equipment	Webb		X	
220719	Plumbing Piping Insulation	Webb		X	
220800	Commissioning of Plumbing	R&B		X	
221113	Facility Water Distribution Piping	DMA		X	
221116	Domestic Water Piping	Webb		X	
221119	Domestic Water Piping Specialties	Webb		X	
221313	Facility Sanitary Sewers	DMA		X	
221316	Sanitary Waste and Vent Piping	Webb		X	
221319	Sanitary Waste Piping Specialties	Webb		X	
221323	Sanitary Waste Interceptors	Webb		X	
221413	Facility Storm Drainage Piping	DMA		X	
221423	Storm Drainage Piping Specialties	Webb		X	
221429	Sump Pumps	Webb		X	
223400	Fuel-Fire, Domestic-Water Heaters	Webb		X	
224213.13	Commercial Water Closets	Webb		X	
224213.16	Commercial Urinals	Webb		X	
224216.13	Commercial Lavatories	Webb		X	
224216.16	Commercial Sinks	Webb		X	
224500	Emergency Plumbing Fixtures	Webb		X	
224716	Pressure Water Coolers	Webb		X	
226113	Compressed-Air Piping for Laboratory and Healthcare Facilities	Webb		X	
226119	Compressed-Air Equipment for Laboratory and Healthcare Facilities	Webb		X	
226213	Vacuum Piping for Laboratory Facilities	Webb		X	
226219	Vacuum Equipment for Laboratory Facilities	Webb		X	
226313	Gas Piping for Laboratory Facilities	Webb		X	
226700	Processed Water Systems for Laboratory Facilities	Webb		X	

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
230100	Basic Mechanical Requirements	Wm. Tao		X	
230500	Basic Mechanical Materials and Methods	Wm. Tao		X	
230600	Piping	Wm. Tao		X	
230800	Commissioning of HVAC	R&B		X	
231900	Mechanical Identification	Wm. Tao		X	
232400	Vibration and Seismic Control	Wm. Tao		X	
232500	Mechanical Insulation	Wm. Tao		X	
235000	HVAC Equipment	Wm. Tao		X	
238800	Air Distribution	Wm. Tao		X	
239500	Controls and Instrumentation	Wm. Tao		X	
239900	Testing, Adjusting and Balancing	Wm. Tao		X	

DIVISION 26 - ELECTRICAL

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
260000	Alternates	Wm. Tao		X	
260100	Basic Electrical Requirements	Wm. Tao		X	
260500	Basic Electrical Materials and Methods	Wm. Tao		X	
260800	Commissioning of Electrical Systems	R&B		X	
261100	Medium Voltage Cables	Wm. Tao		X	
261200	Conductors and Cables (to 600 Volts)	Wm. Tao		X	
261300	Raceways and Boxes	Wm. Tao		X	
261400	Wiring Devices	Wm. Tao		X	
261900	Electrical Equipment Supporting Devices	Wm. Tao		X	
261950	Electrical Identification	Wm. Tao		X	
262400	Vibration and Seismic Control	Wm. Tao		X	
264000	Distribution (to 600 Volts)	Wm. Tao		X	
264500	Grounding and Bonding	Wm. Tao		X	
265100	Indoor Lighting	Wm. Tao		X	
265200	Outdoor Lighting	Wm. Tao		X	
265700	Lighting Control Equipment	Wm. Tao		X	
266000	Special Systems	Wm. Tao		X	
266500	Standby Power Generation System (below 600 Volts)	Wm. Tao		X	
267100	Fire Alarm Systems	Wm. Tao		X	

DIVISION 27 – COMMUNICATIONS

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
270100	Basic Communications Requirements	Faith		X	
270528	Pathways for Communications Systems	Faith		X	

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270536	Cable Trays for Communications Systems	Faith		X	
270540	Communications Grounding and Bonding	Faith		X	
270800	Cable Testing and Administration	Faith		X	
271100	Communications Equipment Room Fittings	Faith		X	
271300	Backbone Cabling Requirements	Faith		X	
271500	Horizontal Cabling Requirements	Faith		X	

DIVISION 31 - EARTHWORK

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
311000	Site Clearing	DMA	X		
311500	Storm Water Pollution Prevention Plan	DMA	X		
312000	Earthwork	DMA	X		
312319	Dewatering	DMA	X		
315000	Excavation Support and Protection	DMA	X		
316329	Drilled Concrete Piers and Shafts	DMA	X		

DIVISION 32 – EXTERIOR IMPROVEMENTS

	Section Name	Author	Bid Package 1 12.03.15	Bid Package 2 03.01.16	Bid Package 3 03.15.16
321216	Asphalt Paving	DMA		X	
321313	Concrete Paving	DMA		X	
321373	Pavement Joint Sealants	DMA		X	
321400	Unit Paving	SWT			X
321443	Porous Unit Paving	SWT			X
328400	Planting Irrigation	SWT			X
329113	Soil Preparation	SWT			X
329200	Turf and Grasses	SWT			X
329300	Plants	SWT			X
329500	Vegetated Roof Assemblies	SWT			X

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SUBSURFACE DRILLING AND SAMPLING INFORMATION

SOIL INVESTIGATION DATA

1. Subsurface soil investigations have been made and the results are bound herein immediately following this page.
2. These investigations are for examination by bidders but are not a part of the Contract Documents.
3. Bidder is responsible for any conclusions drawn from soil investigation data. If he prefers not to assume such risk, he is under obligation to employ his own experts to analyze available information. Bidder is responsible for any consequences of acting on conclusions obtained.
4. Owner does not guarantee continuity of conditions indicated at soil investigation locations.

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**REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL
ENGINEERING EVALUATION**



**WEBSTER UNIVERSITY
INTERDISCIPLINARY SCIENCE BUILDING,
WEBSTER GROVES, MISSOURI**



**PREPARED FOR:
WEBSTER UNIVERSITY
DEPARTMENT OF FACILITIES PLANNING AND MANAGEMENT
ATTENTION: MR. CRAIG MILLER, SR.
470 EAST LOCKWOOD
WEBSTER GROVES, MISSOURI 63119**

**PREPARED BY:
AKINS CONSULTING SERVICES, LLP
1400 SOUTH 3RD STREET
ST. LOUIS, MISSOURI, 63104
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September 28, 2015

Mr. Craig A. Miller, SR
WEBSTER UNIVERSITY
DIRECTOR
Department of Facilities Planning and Management
470 East Lockwood
Webster Groves, Missouri 63119

RE: Revised Report of Subsurface Exploration and Geotechnical Engineering Evaluation
Webster University Interdisciplinary Science Building, Webster Groves, Missouri.

Dear Mr. Miller:

Attached is a revised Subsurface Exploration and Geotechnical Engineering Evaluation of the subject project. Our work was done in general accordance with our proposal dated February 23, 2015. The original report was completed and submitted under a cover dated April 15, 2015. Sections 8, 9 and 10 of the report was revised due to questions and comments from the design team.

The purpose of our work was to determine the general subsurface conditions at specific soil test boring locations and to gather data on which to base comments relative to the selection of foundation types for the proposed structure. This report outlines the exploration procedures used, exhibits the data obtained, and presents our evaluation and recommendations relative to the outlined geotechnical engineering aspects of the project.

We appreciate the opportunity to work with you on this project. Please contact our office if we can be of further assistance.

Respectfully submitted,
AKINS CONSULTING SERVICES, LLP

Joseph S. Osuma, P.E.
Partner

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- A1.3 Pocket Penetrometere
- A1.4 Sample Disposal

APPENDIX A2 - DRILLING AND SAMPLING PROCEDURES

APPENDIX B

- B.1 BORING AND SITE LOCATION PLAN**
- B.2 LOGS OF BORINGS**
- B.3 SUBSURFACE PROFILE**
- B.4 LABORATORY TEST RESULTS**
- B.5 LATERAL LOAD ANALYSIS**

1.0 SCOPE OF WORK

Our work was performed in general accordance with our proposal dated February 23, 2015. A letter of intent in response to our proposal dated March 10, 2015 was issued to ACS by Mr. Craig Miller with Webster University. Our work scope consisted of the following:

- Site reconnaissance, soil test boring layout and soil classification by a staff engineer.
- Subsurface exploration consisting of seven (7) soil test borings drilled to auger refusal. Rock coring at four (4) of the soil test boring locations. Soil sampling at the soil test boring locations consisted of Standard Penetration Tests and Pocket Penetrometer readings at standard intervals.
- Laboratory testing, consisting of:
 - Moisture Content tests.
 - Atterberg Limit tests.
 - Unconfined Compression Test.
 - Unit weight.
 - Sieve Analysis
 - Corrosion Test.
 - Rock Compression Test.
- The analysis and compilation of field and laboratory data and a geotechnical engineering report addressing the following items:
 - Identification and description of the local geologic formations.
 - Subsurface conditions including material types to be expected at existing and proposed grades, and the presence of any unsuitable soil (if encountered).
 - Laboratory test results and soil strength parameters.
 - Site preparation considerations, including criteria for structural backfill, compaction requirement and suitability of the onsite soil for use as structural backfill.
 - Excavation considerations, including suggested slope configuration or system for retention of the perimeter of the excavation.
 - Ground water conditions, including recommendation for the control of groundwater if encountered.
 - Foundation recommendation for the design of the proposed structure, including foundation type, bearing depths, allowable bearing capacity and settlement estimates for the recommended foundation alternate
 - Seismic design considerations in accordance with IBC 2009.
 - Pavement thickness recommendations based on the existing soil conditions.
 - Lateral earth pressure recommendation for the design of below grade walls.
 - Design considerations for ground supported slabs.

2.0 PROJECT AND SITE DESCRIPTION

It is our understanding that the proposed project will involve the design and construction of a new Interdisciplinary Science Building (ISB) within the campus of Webster University in Webster Groves, Missouri. Based on information provided to ACS, the ISB is a three story building with two sub-basement levels. The building area will be approximately 85,000 square feet and will house a new science laboratory, faculty offices, interdisciplinary classrooms and a 129 seat auditorium. Column loads will range from 600 to 900 kips. Lateral column loads will be up to 1,200 kips.

The project site is located within the campus of Webster University. The site is located between Big Bend Road and Garden Avenue. The proposed building is bounded to the north by the Pearson and Priest houses and to the south by the East Academic Building. The site is flanked to the east and west by paved and parking areas. The surface condition observed at the proposed building site consisted primarily of areas of asphalt pavement and landscaped grass.

3.0 LITERATURE REVIEW

In developing the subsurface investigation report, ACS reviewed several literatures, consisting of published geologic literature and subsurface investigation reports previously conducted close to the project site. The items that were reviewed by ACS are:

- Subsurface Investigation Report for the existing Garden Avenue Garage.
- Subsurface Investigation Report for the proposed Garden Avenue Garage - East Addition.
- Drilled Pier Probing results for the Business and Technology Building.
- Geologic Map of St. Louis City and County, Missouri.

3.1 PREVIOUS SUBSURFACE INVESTIGATION REPORTS

The previous subsurface exploration reports were used to compare and substantiate materials encountered during the subsurface investigation for the ISB site. The materials encountered in this investigation were relatively similar; however, the recommendations made in this report are primarily based on the result of the ISB subsurface investigation.

3.2 SITE GEOLOGY

Published geologic literature (Geologic Map of St. Louis City and County, Missouri) obtained from the Missouri Department of Natural Resources indicates that the project site is situated close to the contact zone of two geologic formations, the Cherokee Group Formation and the St. Louis Limestone Formation. The overburden soil overlying both geologic formations consists of an upper layer of silt-rich loess deposits underlain by a deeper layer of clay-rich loess deposits and a thin layer of residual soil. Materials encountered in the soil borings during the subsurface investigation for the ISB are indicative of subsurface materials associated with the St. Louis Limestone Formation.

The Cherokee Group Formation is composed of cyclic deposits. The cyclic deposit of the Cherokee Group Formation generally consists of predominantly layered shale with local layers of sandstone and limestone. The shale layer of the Cherokee Group Formation is a soft rock that can generally be excavated with minimum to intensive effort. Water seepage usually occurs at the contact point of the different rock layers. Soil creep on steep slopes is common in areas underlain by the Cherokee Group Formation. Unstable slopes are usually common, particularly where steep soil slopes are formed on shale.

The rock of the St. Louis Limestone formation is characterized as gray to light gray, massive to medium bedded, fine grain hard limestone. Thin beds of shale are generally common throughout the St. Louis Limestone Formation. Limestone is considered a carbonaceous rock. In our experience with geologic formations consisting of carbonaceous limestone, the bedrock tends

to be prone to solution weathering, thereby, creating a high occurrence of anomalous subsurface conditions, such as highly irregular and cavernous bedrock with the presence of soft saturated clay underlying unweathered rock. The carbonate rock of the St. Louis Limestone Formation is generally jointed and fractured. Solution weathering of the bedrock typically proceeds along the joints and fractures, resulting in a pinnacled bedrock surface and possible horizontal and vertical cavities. Sinkholes may result when overlying material collapses or subsides into the subsurface voids. We did not observe any nor are we aware of the presence of any sinkholes on the site.

3.3 REGIONAL SEISMIC CONSIDERATION

Several significant areas of seismic activity exist in the Central United States. The New Madrid fault zone, the primary region of seismic activity for the mid-continental region, is located approximately 150 miles south of the St. Louis area in the southeast corner of Missouri. The fault zone in this area is characterized by high angle normal faults forming a complex horst and graben system. The strongest recorded earthquakes resulting from this fault zone occurred in December, 1811 through February, 1812, with three principal earthquakes of estimated intensity of XI on the Modified Mercalli Scale. A secondary source of seismic activity is the St. Genevieve fault zone, which extends northwest to southeast from southwestern Illinois towards St. Genevieve County, Missouri. This fault zone's northern terminus is located within 50 miles of the St. Louis area. Several seismic events of body wave magnitude (mb) ranging from 4.5 to 5.8 have been recorded near this fault zone.

4.0 FIELD EXPLORATION AND LABORATORY TESTING

Between March 27, 2015 and March 29, 2015, ACS conducted a subsurface exploration consisting of seven (7) soil test borings for the proposed building. The soil boring locations were surveyed both horizontally and vertically by Glasper Professional Services (GPS) prior to drilling. The soil test boring locations are shown on the Boring Location Plan in Appendix B.

The soil test borings were drilled utilizing a hollow stem auger and soil samples were obtained with a split spoon sampler equipped with an automatic hammer. In addition to the soil drilling, rock core samples were obtained from four (4) soil test boring locations. Rock coring was performed at B-01, B-02, B-06 and B-12. Rock core was accomplished utilizing Nx drilling procedures.

A geotechnical engineer with ACS directed the field investigation during drilling at the site. The geotechnical engineer classified the soil and rock samples, in accordance with ASTM standards on site and, subsequently, transported the soil and rock samples to the laboratory for further classification and testing.

In addition to the field exploration, a limited geotechnical testing program was conducted to determine additional engineering characteristics of selected soil samples. The results of the individual tests are summarized on the Logs of Boring and table in Appendix B. Drilling, sampling and laboratory testing were generally accomplished in accordance with ASTM procedures.

5.0 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered at the test borings are shown on the Logs of Boring and subsurface diagrams in Appendix B. The general subsurface conditions encountered and their pertinent characteristics are described in the sections below. The stratification lines that are indicated on the test boring logs represent approximate boundaries between soil types and it should be noted that the actual transitions between different soil types may be gradual. Conditions represented by the test borings should be considered applicable only at the test boring locations on the dates shown. It should be assumed that the reported conditions might be different at other locations or at other times.

5.1 PAVEMENT SECTION

Soil borings, B-01, B-02 and B-07 were drilled within an existing paved area. The pavement sections observed consisted of an upper layer of asphalt underlain by a crushed limestone base. Table 5.1 below summarizes the pavement sections at locations observed.

TABLE 5.1 – PAVEMENT SECTIONS

BORING No	ASPHALT THICKNESS (IN.)	BASE STONE (IN.)
B-01	3	12
B-02	3	13
B-07	3.5	12

5.2 FILL

Material classified as fill was encountered at soil boring locations B-07, B-13, and B-14. The fill encountered extended to depths of approximately 6 to 8.5 feet below existing ground surface.

The fill consisted of stiff to very stiff, brown and gray silty clay with inclusions of rock fragments in most of the fill samples. The Standard Penetration Test Resistance (N-value) within the fill ranged from 7 blows per foot to 30 blows per foot (bpf). However, the majority of the fill samples exhibited N-values between 10 to 19 bpf. High N-values within the fill samples were judged to be exaggerated due to the presence of rock fragments within the samples.

Pocket Penetrometer readings within the fill layer ranged from 1.5 to 4.5 tons per square foot (tsf). The moisture content tests of the tested fill samples ranged from approximately 15% to 30%.

5.3 NATURAL SOIL

Natural soil at the site consists of an upper layer of loess that transitioned into residual soil before encountering bedrock. Soils transported and deposited by wind are classified as loess. Residual soils are those soils that were formed by the in-place weathering of the parent rock formation.

Natural soil was encountered at all soil test boring locations. The upper layer of the natural soil at the site generally consisted of low to medium plasticity clay that gradually transitioned into a moderate to high plasticity clay.

The majority of the natural soil encountered at the site generally consisted of stiff to very stiff silty clay, with occasional layers of hard consistency silty clay. However, soil test boring B-13, encountered a layer of soft very moist soil from approximately 33 feet to 38 feet below existing ground surface.

The Standard Penetration Test Resistance (N-value) of the natural soil samples ranged from 0 to in excess of 50 bpf. Pocket Penetrometer readings within the natural soil ranged from 0.25 to 4.5 tons per square foot (tsf).

Laboratory tests conducted on representative natural soil samples consisted of moisture contents, shear strength, unit weight and Atterberg Limits tests. Corrosion indication testing consisting of pH and resistivity was also conducted on two representative samples from B-01 and B-07.

The moisture content of the tested soil samples ranged from approximately 17% to 29%. Atterberg limits test results indicated the natural soil to be of low to high plasticity with plasticity index values of 21 and 32.

The shear strength of two (2) tested representative soil samples were 1.12 tsf and 1.91 tsf. The associated dry unit weights of the tested samples were 91.9 pounds per cubic foot (pcf) and 104.2 pcf.

The pH test result for B-01 ranged from 6.7 to is 7.2 with a resistivity of 2,418.5 ohms-cm. The pH test result for B-07 ranged from 6.6 to is 6.9 with a resistivity of 806.2 ohms-cm chloride.

5.4 AUGER REFUSAL

Auger refusal is the drilling depth at which additional penetration with standard soil drilling equipment is no longer possible and rock-drilling procedures must be used to advance the boring. The entire test borings drilled at the site were extended to auger refusal. The depth to auger refusal at the boring locations is summarized in Table 5.2 below:

TABLE 5.2 – AUGER REFUSAL DEPTH

Boring Location	Surface Elev (ft.)	Auger Refusal (ft.)	Top of Rock Elevation (ft.)
B-1	552.2	23.5	528.7
B-2	550.41	33	517.41
B-6	551.59	27.8	523.79
B-7	547.43	19.8	527.63
B-12	553.75	27.5	526.25
B-13	554.05	40.5	513.55
B-14	553.23	29.5	523.73

It should be noted that auger refusal does not necessarily indicate the top of bedrock. Auger refusal can occur on a boulder or obstructions such as old buried concrete, foundation, etc. Soil test borings B-06, B-12 and B-13 did go through a zone of approximately 2 to 5 feet of slow abrasive drilling prior to encountering refusal. B-02 encountered abrasive drilling from 23 to 33 feet. This zone was judged to be a fractured rock zone.

5.5 ROCK

Rock drilling was performed below the refusal depths at soil boring locations B-01, B-02, B-06 and B-12. The total length of rock drilling at the boring locations ranged from 10 to 20 feet depending on the quality of the rock core samples obtained. The rock core samples obtained consisted of hard, fine-grained limestone with medium beds. Some of the rock samples were observed to be interbedded with a thin layer of shale. The upper surface of the rock core was generally observed to be moderately to slightly weathered. The limestone encountered generally transitioned into a slightly weathered to fresh limestone with increasing depth. ***Rock core sample obtained from soil test boring B-12 consisted of an upper 13 feet layer of highly fractured rock with very low Recovery and RQD values. As mentioned previously, some of the soil test borings did encounter a layer of slow abrasive drilling just above refusal depth that we were able to penetrate with a standard soil auger.***



The rock core samples obtained from the majority of the boring locations had a recovery percentage ranging from 95% to 100%. The rock quality designation of the rock core samples ranged from approximately 63.3% to 81.6%; however, rock core sample obtained from soil boring B-12 had a recovery percentage ranging from 30% to 100%. The rock quality designation of the rock core samples ranged from approximately 0% to 33%. The uniaxial compressive strength of the tested rock samples was 14,810 to pounds per square inch (psi).

5.6 GROUNDWATER

Groundwater level in the borings was checked at the time of drilling and at the end of soil drilling at all soil boring locations. Soil test boring B-13 was set up for delayed groundwater measurement and rate of recharge; however, we were not able to obtain the rate of recharge since the borehole collapsed prior to obtaining the rate of recharge. The depth to groundwater is indicated on the soil boring logs and Table 5.3 below.

TABLE 5.3 – GROUNDWATER DEPTHS

BORING NO.	GROUNDWATER DEPTH DURING DRILLING (FT.)	GROUNDWATER DEPTH DURING DRILLING (FT.)	GROUNDWATER DEPTH AFTER 24 HRS DRILLING (FT.)
B-01	NOT ENCOUNTERED	NOT ENCOUNTERED	BACKFILLED
B-02	28.5	23	BACKFILLED
B-06	12.0	6.5	BACKFILLED
B-07	NOT ENCOUNTERED	NOT ENCOUNTERED	-BACKFILLED
B-12	NOT ENCOUNTERED	NOT ENCOUNTERED	BACKFILLED
B-13	32	22.8	21.5
B-14	NOT ENCOUNTERED	NOT ENCOUNTERED	BACKFILLED

The presence or absence of groundwater at a particular location does not necessarily mean that groundwater will be present or absent at that location at other times. Seasonal variations may cause fluctuations in water levels and may cause the presence of water in upper soils. It should also be recognized that perched or trapped water might be encountered within old fill, at the fill/natural soil interface or at the residuum/rock interface. Water level at soil test boring location B-06 was judged to be influenced by the detention basin.

6.0 SITE PREPARATION AND GRADING

The purpose of the subsurface exploration and geotechnical engineering evaluation is primarily to provide information and recommendations relative to site preparation and foundation design for the proposed structure. The following sections provide guidelines for site preparation and grading at the proposed sites.

6.1 SITE PREPARATION

Site preparation for the proposed project would include removing of the existing structures, stripping paved areas and removing any vegetation or deleterious material to a depth where uniform, firm subgrade is encountered. We suggest that removal of existing pavement should be carried out in a manner that will cause the least disturbance to the onsite soil. It has been our experience that the surficial subgrade beneath pavement generally becomes soft and wet over time. Consequently, we do anticipate that remedial work of subgrade beneath old construction may be required.

We recommend that a geotechnical engineer with Akins Consulting Services (ACS) evaluate areas that are at grade or that are to receive engineered fill prior to fill placement or construction. This evaluation may include proofrolling the exposed subgrade with a loaded dump truck or with similar, approved construction equipment. The proofrolling would serve to densify the exposed soils and reveal areas of unsuitable soil where undercutting or remedial work will be required for an acceptable subgrade. **Soft soils encountered at the final subgrade evaluation should be undercut and replaced with engineered fill.** The recommended treatment for unsuitable soil would be undercutting and replacement with an acceptable compacted backfill. However, the extent, nature of the soils encountered, and prevailing weather conditions will influence selection of the most effective method of treating unsuitable soil at the site. Alternative forms of remediation may be acceptable and can be employed after the owner's representative has made an evaluation in the field.

6.2 STRUCTURAL FILL

Structural fill material to replace undercut areas or achieve finished grade should be free of organic and other deleterious material. The fill should consist of low plastic soil, with a liquid limit value of less than 45 and a plasticity index value of less than 25. The largest dimension of rock fragments should be limited to 2 inches and rock fragments should make up no more than 20 % of the fill mass.

Based on the soil test borings and results of the Atterberg Limits test, the onsite soil consists of low to high plastic clays. High plastic clays can be used as fill within landscaped areas.

However, the use of highly plastic clays as fill underneath paved areas and structures should be restricted to depths 3 feet and below subgrade elevation.

Proposed borrow material required to reach final subgrade elevation should be submitted to a geotechnical testing laboratory at least three weeks prior to construction to verify that the fill meets the requirements stated in this section.

The fill should be placed in thin lifts, not exceeding eight inches of loose measure, and compacted to at least 95% of the soil's maximum dry density as determined by the Modified Proctor Compaction Test (ASTM D-1557 or AASHTO T-80). Granular fill and all fill within 18 inches of subgrade elevation should be compacted to achieve a density of 98% of the Modified Proctor.

In addition, the soil should be aerated or moisture-conditioned as necessary to achieve satisfactory moisture content. An engineering technician during fill placement should perform a sufficient number of in-place field density tests. In-place field testing will provide an indication of whether the proper degree of compaction is being obtained and that the moisture content is within the specified range.

6.3 GENERAL EXCAVATION CONSIDERATIONS

Based on information provided to ACS and the results of the subsurface investigation, ACS identified certain factors that will impact excavation and grading at the site. These factors are as follows:

- The ISB subbasement finished floor elevation is at El. 524'.
- Based on the existing site grades, cuts ranging from approximately 23 feet to slightly over 30 feet will be required to reach subgrade elevation.
- The Pearson House is approximately 45 feet north of the proposed ISB building. The basement floor elevation of the Pearson House is at El. 547.89' which is approximately 24 feet higher than the proposed cut. We are unaware of the type of foundation supporting this building, however, we are assuming that the building is supported on conventional strip/spread footings.
- A roadway is planned between the Pearson House and the ISB building.
- The East Academic Building (EAB) is located just south of the ISB building. The lower level finished floor elevation of the EAB is at El. 527.32'. The EAB is supported on drilled shafts. It is likely that the shafts are achieving lateral support from the adjacent soil.

Based on these factors, our comments regarding excavation at the site are presented below:

All borings were extended to auger refusal. The depth to auger refusal ranged from approximately 19.8 to 40.5 feet below existing ground surface. A majority of the soil borings encountered a zone of fractured rock just above the refusal depth which we were able to penetrate with the soil auger.

Based on the anticipated cut to reach the sub-basement finished floor elevation of El. 524', ***it is the opinion of ACS that rock will be encountered at portions of the site prior to reaching the proposed grade.*** The majority of the material encountered above the auger refusal depths in the soil test borings can be excavated using a conventional medium to heavy earth excavating equipment. ***However, intensive excavation efforts would be required in areas where excavation would extend past the auger refusal depths and also within the soil layers identified as fractured rock zones. The fractured rock zone is identified under "Remarks" on the soil boring logs where encountered.*** It is our understanding that blasting will not be permitted at the site; consequently, we recommend the use of heavy duty excavation equipment (such as a track-hoe) fitted with a jack hammer or any other method deemed appropriate by the contractor.

Temporary excavation trenches for utilities and drainage structures should either be sloped or braced in accordance with OSHA Health and Safety standards for excavation. OSHA requires that trench-type excavation greater than five feet in depth be sloped or braced. Minor trench excavations of about 5 feet or less can be sloped or supported with a trench box. The soil at the site can be sloped temporarily at 1(H):1(V).

Major excavations directly adjacent to structures and driveways should be braced or supported. Bracing at the job site can consist of soldier pile and lagging. The soldier piles should be spaced at 8 feet center to center. Due to the presence of rock at or close to the proposed excavation elevation, we recommend that soldier piles should be installed in predrilled boreholes and grouted in place. The predrilled boreholes should extend a minimum of 3 feet into rock. Unbraced vertical cuts should be made after rock is encountered.

The Pearson House is approximately 45 feet north of the proposed ISB Building. Sloped temporary excavation can be made adjacent to the Pearson House, provided a buffer zone of 25 feet is maintained around the perimeter of the building.

Excavation adjacent to the EAB will be approximately 3+ feet lower than the finished floor elevation of the EAB. The contractor should ensure that ground supported slabs and lateral resistance of existing drilled shafts and walls are not impacted during excavation. Actual slope inclinations and the means and methods of excavation support, will be the responsibility of the contractor.

6.4 BACKFILLING OF UTILITY TRENCHES

Backfilling of utility trenches is often accomplished in an uncontrolled manner, leading to the subsequent settlement of fill and cracking of pavements. We recommend that utility trenches within paved areas should be backfilled with compacted granular. The fill should be placed in 6-inch lifts and compacted with pneumatic piston tampers to the project specifications.

6.5 EFFECTS OF GROUNDWATER ON GRADING AND EXCAVATION

Groundwater was encountered only at soil boring locations B-02, B-06 and B-13. Groundwater was encountered at depths ranging from approximately 6.5 feet to 28 feet below the ground surface. Although this subsurface investigation did not encounter any significant amount of groundwater, previous construction activities and reports prepared by others indicate that significant groundwater is generally present and released in excavations within the immediate vicinity of the project site.

Trapped or perched water should be anticipated during excavation at the site, particularly around the existing detention basin. Groundwater released during excavation should be pumped out as appropriate using the conventional sump and pump method or other means deemed appropriate by the contractor.

Proper surface and subsurface drainage will be very important during grading at the site. In areas with exposed soil surface such as pavements and driveways, if the soil becomes wet, pumping type conditions will occur necessitating undercutting or reconditioning of the soil. Pumping and rutting conditions generally occur in areas of construction traffic, particularly after periods of rain. We recommend that the project specification include provisions for the control of both seepage and surface runoff away from the construction area by establishing and maintaining positive drainage within the proposed building area. Exposed soil that is disturbed during construction should be undercut or reconditioned prior to the placement of new fill or construction.

7.0 FOUNDATION RECOMMENDATION

The following comments are based on our findings, our understanding of the project and our experience with similar soil conditions. At the time this report was prepared, the design of the new structure was still in the preliminary stages. If final structural configurations are significantly different from those described in this report, we should be notified and given the opportunity to review our recommendations in light of any such changes.

Based on subsurface information obtained from the soil test borings drilled at the site, previous reports and construction activities within the site vicinity, ACS identified certain factors that would affect the selection of foundation type for the proposed ISB building. These factors are:

- Rock was encountered at or above the proposed subgrade elevation at a majority of the site during our sub surface investigation.
- The elevation to rock for this subsurface investigation is relatively close to the elevation to rock obtained from previous investigations conducted close to the site.
- Soil was encountered at and below the proposed subgrade elevation at localized areas (B-02 and B-13) within the site.

Based on these factors, two alternative types of foundation support were considered and analyzed for the proposed ISB building. The alternative foundation supports that were analyzed are:

- A foundation support consisting strip and spread footings.
- A foundation support consisting of drilled shafts interconnected with grade beams.

It is our opinion that the most cost effective form of foundation support for the structure would be a foundation system consisting of strip and spread footings bearing on rock. However, adjacent foundation supports that span across rock and the isolated areas consisting of soil bearing surface will experience excessive differential settlement if the foundation bearing surfaces are not extended to bear on rock. Drilled shafts interconnected with grade beams may be used as an alternative foundation support in areas where the foundation bearing surfaces would be above rock.

7.1 SPREAD FOOTINGS

The proposed structure can be supported on a system of strip and column footings deriving their support from exposed limestone. However, some of the footing bearing surfaces will be on soil in isolated areas. We recommend footing bearing surfaces consisting of soil should be over-excavated to a depth where rock is exposed in order to minimize differential settlement between adjacent bays.

Strip or column footings bearing rock should be dimensioned for an allowable maximum bearing capacity of 25,000 pounds per square foot (psf).

Additionally, we recommend that the following items be included in the foundation design and project specifications:

1. Minimum dimensions of 24 inches for column footings and 18 inches for rectangular or continuous footings should be included in the footing design. This may involve chipping and breaking rock in order to achieve the required dimension and a level bearing surface.
2. The footing bearing surfaces should be observed by a geotechnical engineer from ACS to confirm that the exposed bearing surface complies with the design bearing pressure. Based on field observations, if localized soft zones are encountered, the footing bearing surface should be extended to rock by undercutting the soil to expose rock. Drilled shafts interconnected by grade beams can be used in lieu of undercutting in these isolated areas. It should be noted that B-02 and B-13 did extend past the subbasement finished floor elevation before encountering refusal. The borings did encounter refusal at depths of approximately 7 feet and 10 feet below the finished floor elevation.
3. The exposed bearing surface in the base of all satisfactory foundation excavations should be protected against any detrimental change in conditions such as disturbance from rain, frost or groundwater seepage. Surface runoff should be diverted away from the footing trench excavations and not be allowed to pond. Water encountered within the footing trench excavation should be pumped out prior to concrete placement.
4. We recommend that footing trench excavations be conducted in accordance with OSHA regulations. It will be the contractor's responsibility to ensure that work is carried in accordance to OSHA regulations and other safety guidelines.

Based on our experience, we estimate that the total settlement of properly designed and constructed spread footings to be less than 1/2-inch.

7.2 DRILLED SHAFTS

The proposed structure could be supported on a system of drilled shafts connected by grade beams. We recommend that drilled shafts bear on the underlying limestone at the site. We suggest that drilled shafts bearing on limestone be dimensioned for a **maximum allowable bearing capacity of 100 ksf**. Based on the above criteria, a 30-inch diameter shaft will develop an allowable load carrying capacity 490 Kips from end bearing.

Information obtained from our subsurface exploration, indicates that rock is present at the subgrade elevation over a majority of the site. Drilled shafts may have to be socketed into rock to achieve the minimum length. An **allowable side resistance value of 15 ksf** can be used for skin friction if a shaft socket is provided within the limestone layer.

Drilled shafts should have a minimum shaft diameter of 30 inches to enable cleaning and inspection of the shaft bottom. The bottom of the shaft should be hand cleaned and inspected to verify that the bearing material is in compliance with the design bearing capacity. Inspection of shafts should, at a minimum, consist of a down-hole inspection and may include drilling a 2-inch diameter test hole at the bearing surface. The length of the test hole should be at least twice the diameter of the shaft or a maximum of 10 feet. Temporary steel casing will be required during drilled shaft installation for maintaining stability of the shaft, and to permit the cleaning and inspection of the shaft bottom. Steel casing can be withdrawn as concrete is placed in the shaft.

Our experience and current research in the field indicates that concrete can be placed in drilled shafts by the “free fall method” without affecting the strength and quality of the in-place concrete. Concrete should free fall without hitting the sides of the excavation or reinforcing steel. The use of a hopper or other suitable device is also recommended to control concrete placement. Steel casing can be withdrawn as concrete is placed.

7.3 LATERAL ANALYSIS

Lateral capacities and deflections for each column location are not within the scope of this report. However, we conducted a two different lateral capacity and deflections analyses using the LPILE computer software. The two analyses were performed on a 30-inch and a 36-inch diameter drilled shaft embedded 10 feet into rock. In one case we assumed the elevation of rock at El. 524 feet and in the second case we assumed the elevation of rock to be at El. 512 feet. The soil parameters used in the analysis are provided in Table 7.1 below. These soil parameters are based on the subsurface information obtained from the soil borings, published correlations and interpretation of the subsurface conditions by the geotechnical engineer. The print out of the lateral load analysis is included in Appendix B.

TABLE 7.1 – SOIL PARAMETERS FOR LATERAL LOAD ANALYSIS

Depth (Ft.)	Soil Strength	Soil Modulus Parameter k (pci)	Strain at 50% maximum stress	Unit Weight (pcf)	P-Y Curve
524 – Bedrock*	0.75ksf	100	0.01	57.6	STIFF CLAY NO WATER
Rock	Qu = 3 ksi	---		145	VUGGY LIMESTONE
*top of bedrock varies between El. 528.5 (B-01) and approximately El. 513(B-13)					

7.4 SEISMIC CONSIDERATIONS

The International Building Code (IBC) requires the structural design of structures to withstand seismic forces. Site coefficients, which are a function of the soil type, strength consistency, and depth to bedrock, are required for the calculation of minimum earthquake design forces. Based on the soils encountered within the soil test borings and depth to bedrock, the IBC 2012 Site Classification for the project site is Site Class B. According to the USGS website, the peak acceleration in rock at the site for the 500 year return, 1000 year return and 2500 year return periods are 0.07g, .012g and 0.21g respectively.

Seismic parameters for Maximum Considered Earthquake (MCE) as per IBC 2012 are provided below.

Duration (Seconds)	Acceleration a (g)
0.2 (S_s)	0.419
1.0 (S_1)	0.163

8.0 RETAINING WALL

8.1 LATERAL EARTH PRESSURES REVISED PER WEBSTER UNIVERSITY'S REQUEST ON 9/24/2015

Walls that are free to move and deflect at the top should be designed to resist active earth pressure. Walls that are restricted from movement at the top should be designed to resist at-rest earth pressures. Earth pressure is a function of the excavation configuration and the backfill materials. Lateral earth pressure is developed from the soils present within a wedge formed by the retaining wall and a line extending up from the bottom at a 45° angle.

The following design parameters are recommended for the retaining wall design.

TABLE 8.1 REVISED 9/24/2015 – LATERAL EARTH PRESSURE PARAMETERS

	Low Plasticity Cohesive Soils	Limited Granular Material	Granular Material
Soil Angle of Internal Friction	24	28	34
Slope Profile	Horizontal	Horizontal	Horizontal
Soil Unit Weight (pcf)	120	118	115
Assumed Surcharge Condition	NONE	NONE	NONE
At-Rest Equivalent Fluid Pressure (pcf)	71	62.60	51
Active Equivalent Fluid Pressure (pcf)	51	43	33

The design parameters above are for a fully drained condition, no surcharge. Retaining walls should be provided with a drain system and discharged through designed weep holes or via other drains to allow for dissipation of any water pressure, which may develop behind the wall. The drainage system should consist of 4 or 6-inch PVC pipe or equivalent with ¼ or 3/8-inch perforations. The pipe should be laid with perforations down and surrounded with ¾ or 1-inch clean crushed rock or gravel that extends a minimum of 2 feet horizontally from the wall to within 2 feet of the adjacent ground surface. The crushed rock or gravel should be surrounded with a separation geo fabric at all locations where it comes in contact with soil. The drainage system should be routed to a sump where it will be collected and pumped or graded to discharge through gravity. The drain should be capped with 2 feet of silty clay soil to prevent surface water from entering the drain.

9.0 GROUND SUPPORTED SLAB REVISED PER WEBSTER UNIVERSITY'S REQUEST ON 9/25/2015

Ground supported slab for the building is anticipated to bear mostly on rock with isolated areas bearing on soil. We recommend that all ground supported slab on rock should be founded on 4 inches of compacted granular material. In areas where the support will transition into soil, we recommend that all ground supported slab should be founded on 6 inches of compacted granular material in order to achieve a more uniform support. A maximum particle size of 1 inch is recommended for the under-slab granular material.

Ground supported slab should be provided with an adequate number of joints to reduce cracking resulting from any differential movement. In addition the following general guidelines are provided for the design and construction of ground supported slabs.

Information provided to ACS, indicates that significant groundwater was encountered and released during construction of EAB building which is adjacent to the ISB site. It is our understanding that permanent groundwater control for the EAB building consist of slab/wall underdrains, sumps and pumps.

Significant groundwater was not encountered during our subsurface exploration. However, the absence of significant groundwater during our subsurface exploration could be as a result of the groundwater control system that is currently in place and does not necessarily indicate the groundwater level at the site. Based on these factors, the design team has assumed that the subbasement finished floor would be constructed below the groundwater table. In lieu of raising the grade of the proposed building, we recommend that the design of the ISB building should include an in place permanent groundwater control system. This system should include a subsurface drain system discharged by gravity or collected and pumped.

The slab drainage system should consist of 4 or 6-inch PVC pipe or equivalent with 1/4 or 3/8-inch perforations. The pipe should be laid with perforations down and surrounded with 3/4 or 1-inch clean crushed rock or gravel. The crushed rock or gravel should be surrounded with a separation geo fabric at all locations. The drainage system should be routed to a sump where it will be collected and pumped or graded to discharge through gravity. Outlets for the slab drains should be constructed and maintained separately from retaining wall and foundation drains. In addition, a suitable waterproofing membrane is recommended beneath any below grade floor or walls areas to reduce the potential for dampness.

10.0 PAVEMENT CONSIDERATIONS REVISED PER WEBSTER UNIVERSITY'S REQUEST ON 7/28/2015

Pavement thickness largely depends on the traffic load. ACS has not been provided with the proposed traffic load for the pavement; however, we anticipate that the majority of the traffic associated with the new building will consist of light passenger cars and moderate to heavy trucks. Parking areas that are restricted to automobiles and light trucks should consist of an 8-inch thick crushed stone base with a minimum 3.5-inch thick asphalt. Moderate duty traffic applications, such as entrance drives, and other areas that will receive heavy traffic volumes or light truck traffic should have a minimum section of a 10-inch thick crushed stone base with a 6-inch thick asphaltic concrete surface course. Heavy duty pavement sections such as trash dumpster pads and trash truck approaches and maneuvering areas should be a minimum of 7-inch thick concrete underlain by 4-inch of compacted crushed stone.

The crushed stone base should be placed and compacted to a minimum dry density of 95 percent of the maximum dry density as determined by the Modified Proctor test. Asphaltic concrete should comply with and be placed as specified by the local highway departments.

Prior to placing the crushed stone base, the subgrade should be proofrolled and compacted as specified in Section 6 of this report. Areas which "pump" during proofrolling should be stabilized prior to placement of the crushed stone base. Stabilization may require removing a portion of the subgrade and replacing it with a crushed stone sub-base, installing a geotechnical stabilization geogrid or fabric, or a combination of the above. It is essential that a proper subgrade be prepared in order to ensure long-term performance of the pavement section.

11.0 CONSTRUCTION MONITORING AND TESTING

The analysis and recommendations submitted in this report are based, in part, upon the data obtained from the test borings. The nature and extent of variations between the borings may not become evident until construction. If variations then appear evident, it may be necessary to re-evaluate the recommendations of this report. Consequently, it is imperative that ACS is retained and involved in the final design and construction observation.

We strongly recommend that Akins Consulting Services, LLP (ACS) be retained to provide a comprehensive construction monitoring program to assist the Owner in determining that the work is being carried out in general conformance with the plans and specifications. Construction monitoring should include foundation excavation and drilled shaft installation observation, testing of construction materials, such as compacted fill, concrete and engineering observation during the construction phase of the project.

11.1. FILL MONITORING

ACS recommends that in-place density tests be performed in the field by an engineering technician to evaluate the contractor's performance with regard to meeting the project specifications for fill placement. A sufficient amount of testing and monitoring will be required during fill placement to provide a high degree of confidence that the fill is *uniformly* placed in accordance with the project requirements.

11.2 FOUNDATION OBSERVATION

ACS recommends that all foundation construction should be monitored by a geotechnical engineering geologist from ACS. Such observation is necessary to determine the appropriateness of the bearing level, the adequacy of the bearing materials and the conformity to the project plans and specifications with respect to depths, plan dimension, cleanliness, etc.

12.0 GENERAL REMARKS/REPORT LIMITATIONS

This report has been prepared for the exclusive use of **WEBSTER UNIVERSITY**, for the specific application to the subject project. All recommendations contained in this report have been made in accordance with generally accepted soil and foundation engineering practices. No other warranties are implied or expressed.

We emphasize that this report is for design purposes only and may not be sufficient to prepare an accurate bid. Contractors reviewing this report should acknowledge that the discussions and recommendations contained herein are for design purposes.

When the plans and specifications are more complete or if significant changes are made in the nature of the proposed project, a consultation should be arranged to review them with respect to prevailing soil conditions. At that time it may be necessary to submit supplementary recommendations.

We also suggest that the geotechnical engineer be given the opportunity to review the plans and specifications to verify that the recommendations in this report are properly interpreted and incorporated into the design.

APPENDIX A1

APPENDIX A1 - SUMMARY OF LABORATORY TESTING

Laboratory testing was performed on selected representative samples to evaluate pertinent engineering properties of the soils. To supplement the visual classification of the soil samples, the following tests were performed. These laboratory tests were performed in accordance with applicable ASTM standards.

A1.1 NATURAL MOISTURE CONTENTS

Natural moisture contents were evaluated on selected samples. The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of soil particles. The results are indicated on the Logs of Boring in Appendix B.

A1.2 ATTERBERG LIMITS

Atterberg limits tests were performed to evaluate the soil's plasticity characteristics. The soil Plasticity Index (P.I.) is representative of this characteristic and is bracketed by the Liquid Limit (L.L.) and the Plastic Limit (P.L.). The Liquid Limit is the moisture content at which the soil will flow as a heavy viscous fluid. The Plastic Limit is the moisture content at which the soil is between the "plastic" and the semi-soil stage. The results of these tests are presented in Appendix B. The Plasticity Index ($P.I. = L.L. - P.L.$) is a frequently used indicator for the soil's potential for volume change. Typically, volume change potential increases with higher plasticity indices.

A1.3 POCKET PENETROMETER

Pocket Penetrometer (P.P.) tests were performed on cohesive soil samples. The pocket Penetrometer provides a consistency classification and an indication of the soil's unconfined compressive strength. The pocket penetrometer readings are indicated on the logs of borings.

A1.4 SAMPLE DISPOSAL

ACS stores representative samples at its facility for further analysis, if desired. Unless ACS is otherwise notified, all samples will be disposed of after 60 days.

APPENDIX A2

APPENDIX A2 - DRILLING AND SAMPLING PROCEDURES

Soils drilling and sampling operations were conducted in general accordance with ASTM D-1586-67. The borings were advanced by mechanically twisting continuous hollow stem auger flights into the ground. Samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated six inches to penetrate any loose cuttings, and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot of penetration was recorded and designated as the standard Penetration Test "N-Value". The penetration resistance, when properly evaluated, is an index to the soil's strength, density, and behavior under applied loads.

In addition to the standard soil drilling, rock coring and sampling was also conducted below the auger refusal depths at selected boring locations. The borings were further advanced by mechanically twisting an NX casing core barrel with drill bit under pressure. Water under pressure was forced down the core barrel and into the bit to carry the rock dust out of the borehole as the water is circulated.

The recovery ratio (defined as Length of Rock Sample Recovered / Length of Core Advanced) and the rock quality designation, RQD, (defined as Length of Intact Core Pieces > 4 inch / Length of Core Advanced) was determined for the recovered samples. The rock quality designation (RQD) when properly evaluated is a measure of the quality of the rock mass which may used to approximately establish field reduction of the modulus of elasticity and compressive strength.

APPENDIX B.1

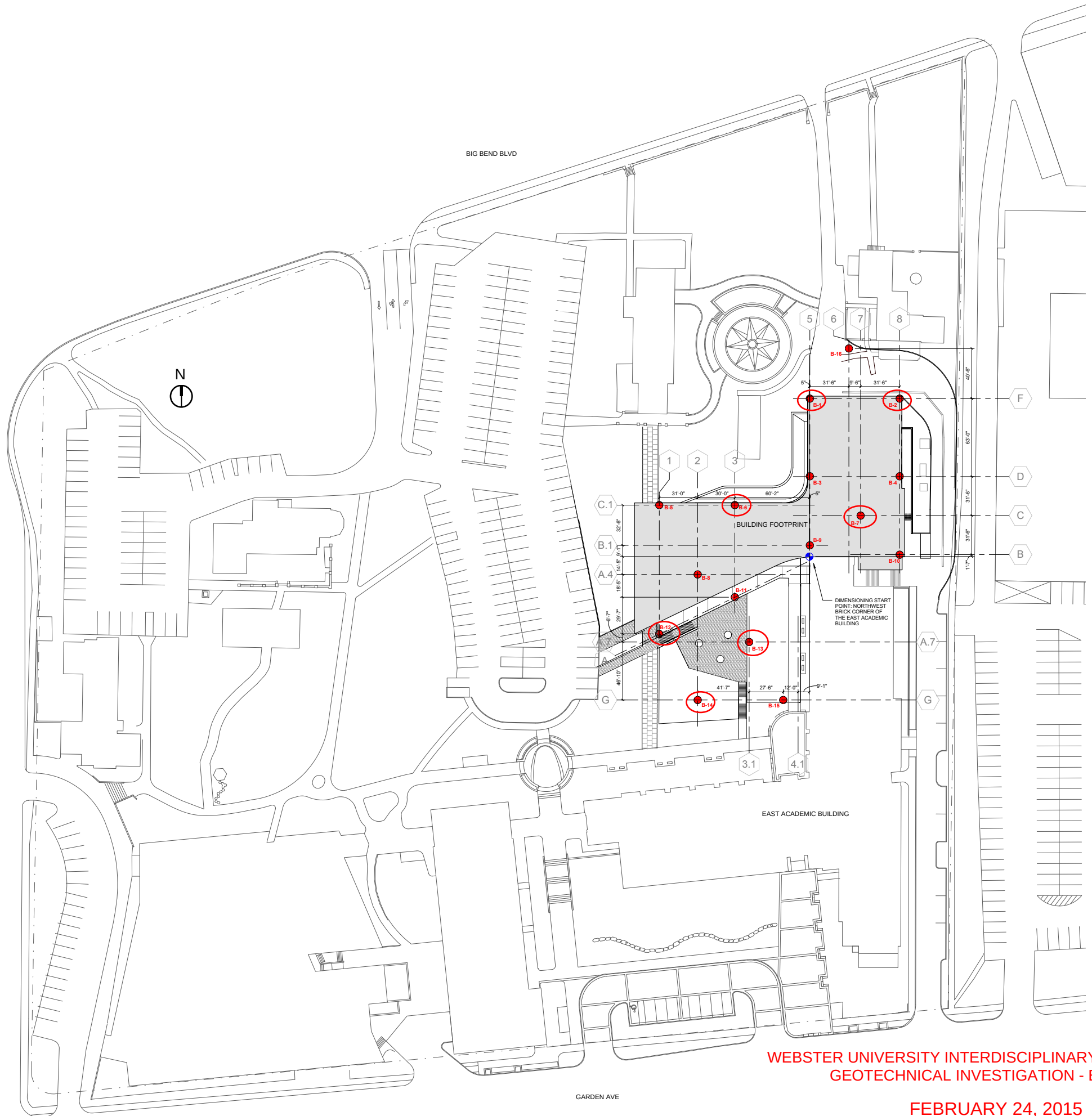


EXHIBIT A

WEBSTER UNIVERSITY INTERDISCIPLINARY SCIENCE BUILDING (ISB)
GEOTECHNICAL INVESTIGATION - BORINGS LOCATION PLAN

FEBRUARY 24, 2015 Boring Location Plan
NTS

APPENDIX B.2

SHEET 1 of 2

SHEET 1 of 2



Akins Consulting Services LLP
1400 South 3rd Street
St. Louis, MO 63104
(314) 499-4227

CLIENT:	Webster Univesity
PROJECT:	Interdisciplinary Science Building
LOCATION:	Webster Groves, Missouri
NUMBER:	022315

DATE(S) DRILLED: 3/29/15 - 3/29/15

DRILLING METHOD(S):
HSA and Nx

GROUNDWATER INFORMATION:
Groundwater was not encountered during and after drilling.

SURFACE ELEVATION: 552.2

DESCRIPTION OF STRATUM

3-Inch Asphalt
12-Inch Crushed Stone

Stiff, gray and brown silty CLAY.

Stiff, gray and brown silty CLAY with manganesse dioxide stain.

Stiff, gray and brown silty CLAY with manganesse dioxide stain.

Stiff, gray and brown silty CLAY with manganese dioxide stain with slight gasoline odor.
[pH distilled = 7.2; pH CaCL = 6.7; Resistivity = 2,418.5 ohms-cm]

Stiff, gray and brown silty CLAY with manganesse dioxide stain.

Very stiff, brown silty CLAY with manganese dioxide stain.

Auger refusal at 23.5 feet.
LIMESTONE, hard, gray. moderately weathered to slightly

REMARKS:

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEI.GDT 4/8/15

LOG OF BORING B-01

SHEET 2 of 2



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CLIENT: Webster Univesity
PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/29/15 - 3/29/15

DRILLING METHOD(S):
HSA and Nx

GROUNDWATER INFORMATION:
Groundwater was mot encountered during and after drilling.

DESCRIPTION OF STRATUM

wearhered, finely crystalline.



LIMESTONE, hard, gray. moderately weathered to slightly wearhered, finely crystalline.



LIMESTONE, hard, gray. slightly wearhered, finely crystalline.



Coring Terminated at 38.5 feet.

REMARKS:

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING B-02

SHEET 1 of 2



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CLIENT: Webster Univesity
PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/29/15 - 3/29/15

DRILLING METHOD(S):
HSA and Nx

GROUNDWATER INFORMATION:

Groundwater was encountered at 28.5 feet during drilling and at 23 feet before commencing rock coring .

SURFACE ELEVATION: 550.4

DESCRIPTION OF STRATUM

3-Inch Asphalt.

13-Inch Crushed Stone.

Very stiff, gray and brown silty CLAY.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff to hard, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff, brown silty CLAY with manganesse dioxide stains.

Hard, brown silty CLAY with manganesse dioxide stains.

REMARKS:

Abrasive slow drilling from 23.5 feet to refusal. Fractured rock zone.

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEI.GDT 4/8/15

	FIELD DATA								LABORATORY DATA									
SOIL SYMBOL	DEPTH (FT)	ELEVATION (FT)	SAMPLES	N: BLOWS/FT	P: TSF	T: TSF	PERCENT RECOVERY	ROCK QUALITY DESIGNATION	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY (lbs/ft³)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MINUS NO. 200 SIEVE (%)	
									LL	PL	PI							
		550																
				8	3.0		100		25									
	-5	545		8	2.5		100		23									
				8	2.5		100		24									
	-10	540		9	2.5		100		27	51	19	32					97	
				13	4.5		100											
	-15	535																
				14	3.5		67											
	-20	530																
				53	4.0		67											
	-25																	

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

SHEET 2 of 2

SHEET 2 of 2



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CLIENT:	Webster Univesity
PROJECT:	Interdisciplinary Science Building
LOCATION:	Webster Groves, Missouri
NUMBER:	022315
DATE(S) DRILLED:	3/29/15 - 3/29/15

DRILLING METHOD(S):
HSA and Nx

GROUNDWATER INFORMATION:

Groundwater was encountered at 28.5 feet during drilling and at 23 feet before commencing rock coring .

DESCRIPTION OF STRATUM

Stiff, very moist, brown silty CLAY with rock fragments and trace of sand.

Auger Refusal at 33 feet.

LIMESTONE, hard, gray, moderately weathered to slightly wearhered, finely crystalline.



LIMESTONE, hard, gray. slightly weathered, finely crystalline.



LIMESTONE, hard, gray. slightly weathered to unweathered, finely crystalline.

Coring Terminated at 48 feet.

REMARKS:

Abrasive slow drilling from 23.5 feet to refusal. Fractured rock zone.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEIGDT 4/8/15

LOG OF BORING B-06

SHEET 1 of 2



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CLIENT: Webster Univesity
PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/28/15 - 3/28/15

DRILLING METHOD(S):
HSA and Nx

GROUNDWATER INFORMATION:

Groundwater was encountered at 12 feet during drilling and at 6.5 feet prior to rock coring.

SURFACE ELEVATION: 551.6

DESCRIPTION OF STRATUM

Stiif, moist brown silty CLAY with rock fragments.

Medium, moist brown silty CLAY.

Soft to medium, moist gray and brown silty CLAY with manganesse dioxide stains.

Stiff, gray and brown silty CLAY with manganesse dioxide stains.

Stiff, gray and brown silty CLAY with manganesse dioxide stains.

Stiff, gray and brown silty CLAY with rock fragment and manganesse dioxide stains.

REMARKS:

Abrasive slow drilling from 25 feet to refusal. Fractured rock zone. Water level possibly influenced by adjacent detention basin.

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEI.GDT 4/10/15

SOIL SYMBOL	FIELD DATA							LABORATORY DATA									
	DEPTH (FT)	ELEVATION (FT)	SAMPLES	N: BLOWS/FT	P: TSF	T: TSF	PERCENT RECOVERY	ROCK QUALITY DESIGNATION	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY (lbs/ft³)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MINUS NO. 200 SIEVE (%)
										LL	PL	PI					
	5	550		4	1.75		100		29								
				4	1.0		100		27								
		545		3	0.25		80		30								
		10		7	1.25		100		26								
	15	540						▽									
				9	3.0		100										
		535															
		20		8	2.5		100										
	25	530															
				13	2.5		80										

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING B-06

SHEET 2 of 2



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PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/28/15 - 3/28/15

DRILLING METHOD(S):
HSA and Nx

GROUNDWATER INFORMATION:

Groundwater was encountered at 12 feet during drilling and at 6.5 feet prior to rock coring.

DESCRIPTION OF STRATUM

Auger Refusal at 27.8 feet.

LIMESTONE, hard, gray. weathered to slightly weathered, finely crystalline.



LIMESTONE, hard, gray. slightly weathered to unweathered, finely crystalline.



Coring Terminated at 37.8 feet.

REMARKS:

Abrasive slow drilling from 25 feet to refusal. Fractured rock zone. Water level possibly influenced by adjacent detention basin.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING B-07

SHEET 1 of 1



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PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/28/15 - 3/28/15

DRILLING METHOD(S):
HSA

GROUNDWATER INFORMATION:
Groundwater was not encountered during and after drilling.

SURFACE ELEVATION: 547.4

DESCRIPTION OF STRATUM

3.5-inch ASPHALT.
12-inch Crushed Stone

Brown silty CLAY and rock fragments.

Stiff, gray silty CLAY and rock fragments.

Very stiff, gray and brown silty CLAY with manganese dioxide stains.
[pH distilled = 6.9; pH CaCL = 6.6; Resistivity = 806.2 ohms-cm]

Very stiff, gray and brown silty CLAY with manganese dioxide stains.

Very stiff, gray and brown silty CLAY with manganese dioxide stains.

Very stiff, gray and brown silty CLAY with manganese dioxide stains.

Auger Refusal at 19.8 feet.

REMARKS:

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEI.GDT 4/10/15

LOG OF BORING B-12

SHEET 1 of 2



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PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/27/15 - 3/27/15

DRILLING METHOD(S):
HSA and Nx

GROUNDWATER INFORMATION:
Groundwater was mot encountered during and after drilling.

SURFACE ELEVATION: 553.8

DESCRIPTION OF STRATUM

Hard, brown silty CLAY and rock fragments.

Very stiff, gray and brown silty CLAY.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

Hard, brown silty CLAY with manganesse dioxide stains.

Stiff to very stiff, gray silty CLAY with rock fragments.

REMARKS:

Abrasive slow drilling from 25 feet to refusal. Fractured rock zone.

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEL.GDT 4/10/15

	FIELD DATA								LABORATORY DATA									
SOIL SYMBOL	DEPTH (FT)	ELEVATION (FT)	SAMPLES	N: BLOWS/FT	P: TSF	T: TSF	PERCENT RECOVERY	ROCK QUALITY DESIGNATION	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY (lbs/ft³)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MINUS NO. 200 SIEVE (%)	
										LL	PL	PI						
	5	550		9	4.5		67		18									
				5	2.0		77		22									
				11	3.0		100		25	42	21	21						
				11	2.75		100		23									
	15	540		6	1.75		100											
20	535		15	4.0		100												
25	530		9	2.0		100												

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING B-12

SHEET 2 of 2



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PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/27/15 - 3/27/15

DRILLING METHOD(S):
HSA and Nx

GROUNDWATER INFORMATION:
Groundwater was not encountered during and after drilling.

DESCRIPTION OF STRATUM

Auger Refusal at 27.5 feet.

LIMESTONE, hard, gray, wearhered, highly fractured.



LIMESTONE, hard, light brown, decomposed to highly wearhered, fractured.



LIMESTONE, hard, gray, highly wearhered, interlayered with shale.



LIMESTONE, hard, gray, interbedded with thin layers of shale.



- Transition into shale from 46.75 to 47.5 ft.

Coring Terminated at 47.5 feet.

REMARKS:

Abrasive slow drilling from 25 feet to refusal. Fractured rock zone.

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEL.GDT 4/10/15

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING B-13

SHEET 1 of 2



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CLIENT: Webster Univesity
PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/28/15 - 3/28/15

DRILLING METHOD(S):
HSA

GROUNDWATER INFORMATION:

Grounwater was encountered at 32 feet during drilling, at 22.8 feet immediately after drilling and at 21.5 feet 24 hours after drilling.

SURFACE ELEVATION: 554.1

DESCRIPTION OF STRATUM

Stiff, brown silty CLAY with rock fragments. (Fill)

Very stiff to hard, brown silty CLAY with rock fragments. (Fill)

Stiff, gray silty CLAY with rock fragments. (Fill)

Stiff, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

Very stiff, gray and brown silty CLAY with manganesse dioxide stains.

REMARKS:

Abrasive slow drilling from 23.5 to 28 feet and from 38.5 feet to refusal. Fractured rock zone.

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OELGDT 4/8/15

	FIELD DATA								LABORATORY DATA									
SOIL SYMBOL	DEPTH (FT)	ELEVATION (FT)	SAMPLES	N: BLOWS/FT	P: TSF	T: TSF	PERCENT RECOVERY	ROCK QUALITY DESIGNATION	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY (lbs/ft³)	COMPRESSIVE STRENGTH (tsf)	FAILURE STRAIN (%)	CONFINING PRESSURE (psi)	MINUS NO. 200 SIEVE (%)	
										LL		PL						PI
										LIQUID LIMIT	PLASTIC LIMIT							
		550		10	1.5		77		15									
				10	4.5		100		19									
				14	3.0		88		19									
		545		8	2.0		100		29									
		540		8	3.25		100											
		535		8	2.25		100											
		530		8	2.75		100											

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING B-13

SHEET 2 of 2



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CLIENT: Webster Univesity
PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/28/15 - 3/28/15

DRILLING METHOD(S):
HSA

GROUNDWATER INFORMATION:

Grounwater was encountered at 32 feet during drilling, at 22.8 feet immediately after drilling and at 21.5 feet 24 hours after drilling.

DESCRIPTION OF STRATUM

Soft, moist brown silty CLAY.

Soft, very moist, brown silty CLAY and rock fragments.

Auger Refusal at 40.5 feet.

REMARKS:

Abrasive slow drilling from 23.5 to 28 feet and from 38.5 feet to refusal. Fractured rock zone.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEL.GDT 4/8/15

LOG OF BORING B-14

SHEET 1 of 2



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CLIENT: Webster Univesity
PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/27/15 - 3/27/15

DRILLING METHOD(S):
HSA

GROUNDWATER INFORMATION:
Groundwater was not encountered during and after drilling.

SURFACE ELEVATION: 553.8

DESCRIPTION OF STRATUM

Hard, brown silty CLAY and rock fragments.

Stiff, brown silty CLAY and rock fragments.

Very stiff, gray and brown silty CLAY with manganese dioxide stains.

Very stiff, gray and brown silty CLAY with manganese dioxide stains.

Stiff, gray and brown silty CLAY with manganese dioxide stains.

Very stiff, gray and brown silty CLAY with manganese dioxide stains.

Very stiff, gray and brown silty CLAY with manganese dioxide stains.

REMARKS:

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

LOG OF BORING WEBSTER UNIVERSITY ISB (2).GPJ OEL.GDT 4/8/15

LOG OF BORING B-14

SHEET 2 of 2



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St. Louis, MO 63104
(314) 499-4227

CLIENT: Webster Univesity
PROJECT: Interdisciplinary Science Building
LOCATION: Webster Groves, Missouri
NUMBER: 022315

DATE(S) DRILLED: 3/27/15 - 3/27/15

DRILLING METHOD(S):
HSA

GROUNDWATER INFORMATION:
Groundwater was not encountered during and after drilling.

DESCRIPTION OF STRATUM

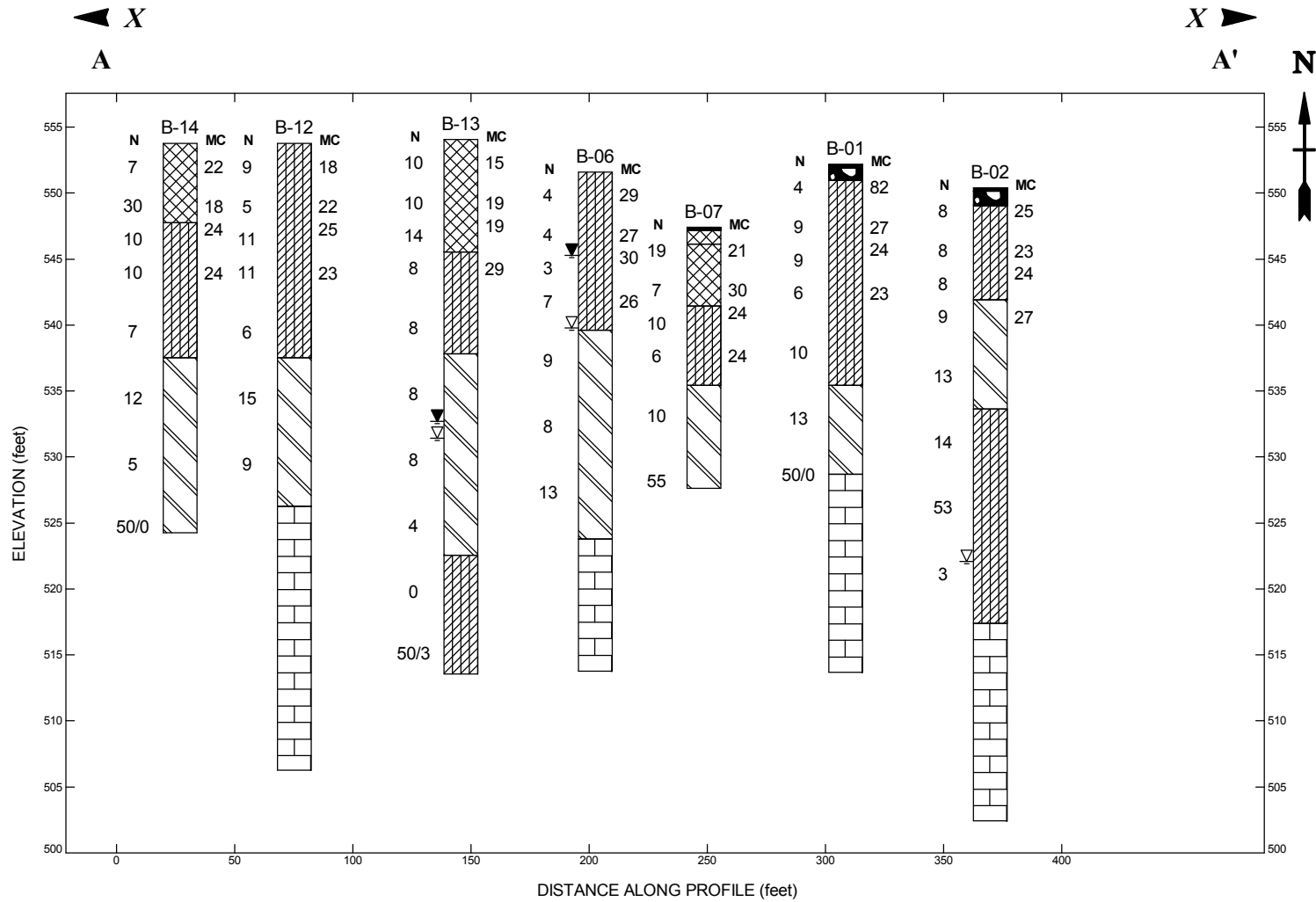
Stiff, gray silty CLAY and limestone fragments.

Auger Refusal at 29.5 feet.

REMARKS:

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - POCKET TORVANE SHEAR STRENGTH

APPENDIX B.3

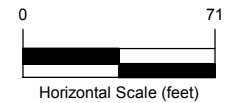
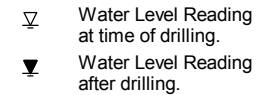
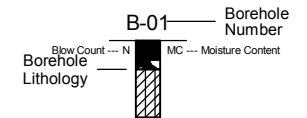


Lithology Graphics



Site Map Scale 1 inch equals 260 feet

Explanation



Vertical Exaggeration: 5.5x

WEBSTER UNIV. IS BUILDING A-A' SUBSURFACE PROFILE

Interdisciplinary Science Building
Webster Groves, Missouri

JOB NUMBER
022315

PLATE NUMBER
A-1



Akins Consulting Services LLP
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APPENDIX B.4

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Classification	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio
B-01	1.0							82.1			
B-01	4.0							26.6			
B-01	6.5							23.8			
B-01	9.0							23.0			
B-02	1.0							25.1			
B-02	4.0							22.6			
B-02	6.5							24.1			
B-02	9.0	51	19	32	0.075	97	CH	26.9			
B-06	1.0							29.0			
B-06	4.0							27.4			
B-06	6.5							29.6			
B-06	9.0							26.1			
B-07	1.0							21.1			
B-07	4.0							30.1			
B-07	6.5							23.8			
B-07	9.0							24.2			
B-12	1.0							17.9			
B-12	4.0							21.9			
B-12	6.5	42	21	21				24.9			
B-12	9.0							23.1			
B-13	1.0							15.3			
B-13	4.0							18.7			
B-13	6.5							19.0			
B-13	9.0							29.0			
B-14	1.0							22.2			
B-14	4.0							18.3			
B-14	6.5							24.4			
B-14	9.0							24.4			



Akins
consulting services llp

Akins Consulting Services LLP
1400 South 3rd Street
St. Louis, MO 63104
(314) 499-4227

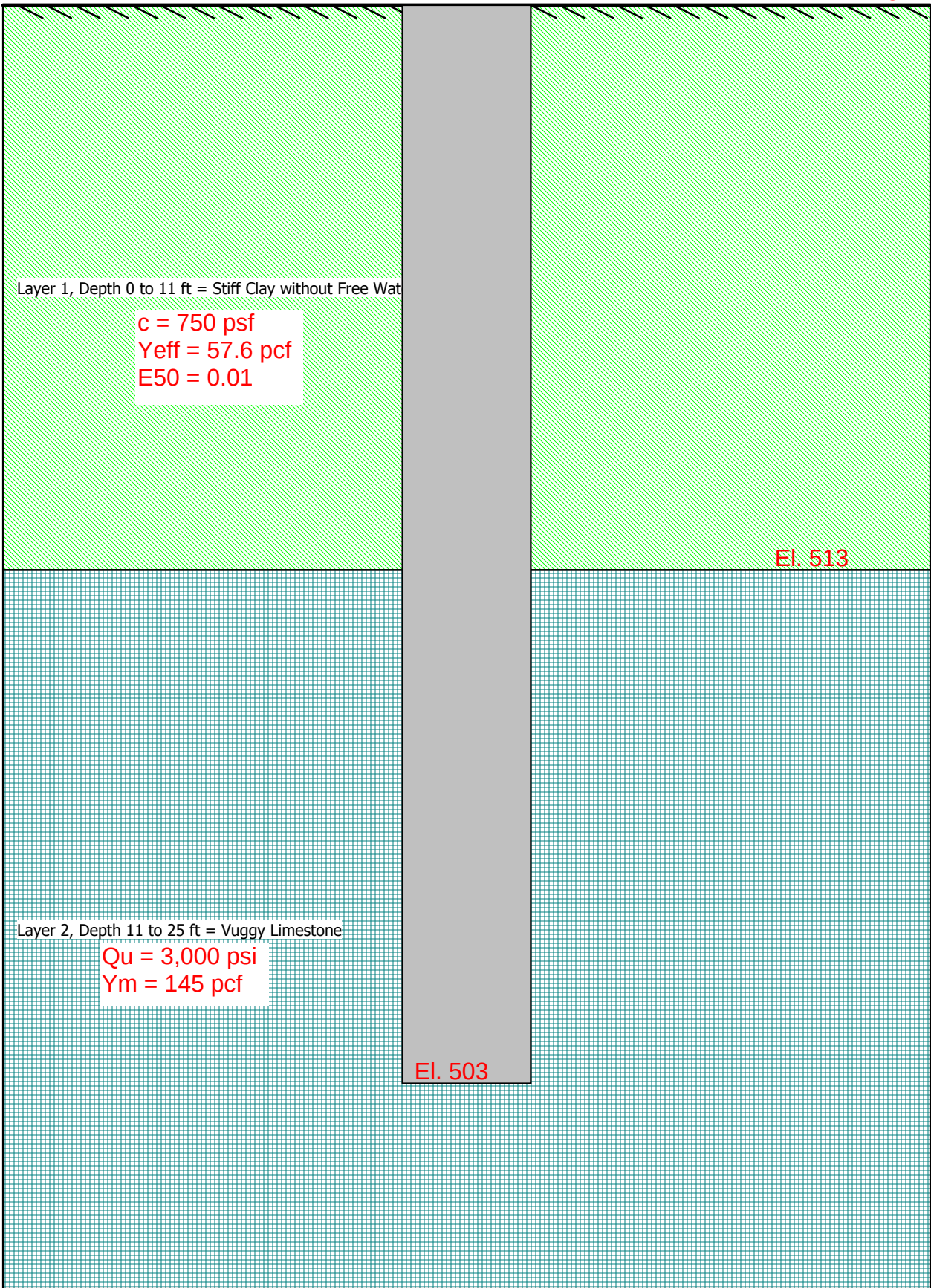
Summary of Laboratory Results

Project: Interdisciplinary Science Building
Location: Webster Groves, Missouri
Number: 022315

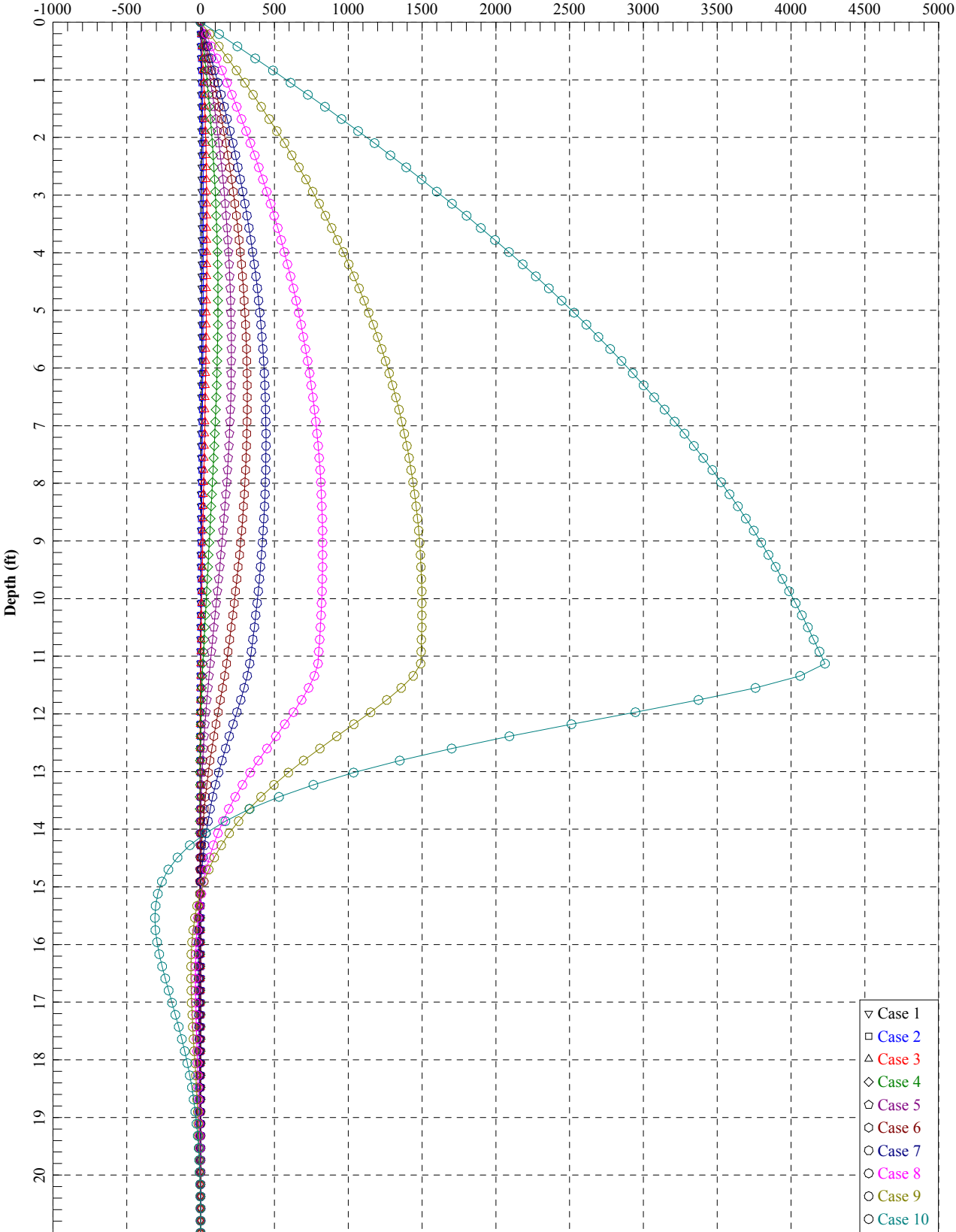
APPENDIX B.5

**DRILLED SHAFT - SOIL PROFILE [11 FT
OVERBURDEN]**

El. 524



SCIENCE BUILDING: 30-INCH DIAMETER DRILLED SHAFT
Bending Moment (in-kips)



SCIENCE BUILDING: 30-INCH DIAMETER DRILLED SHAFT

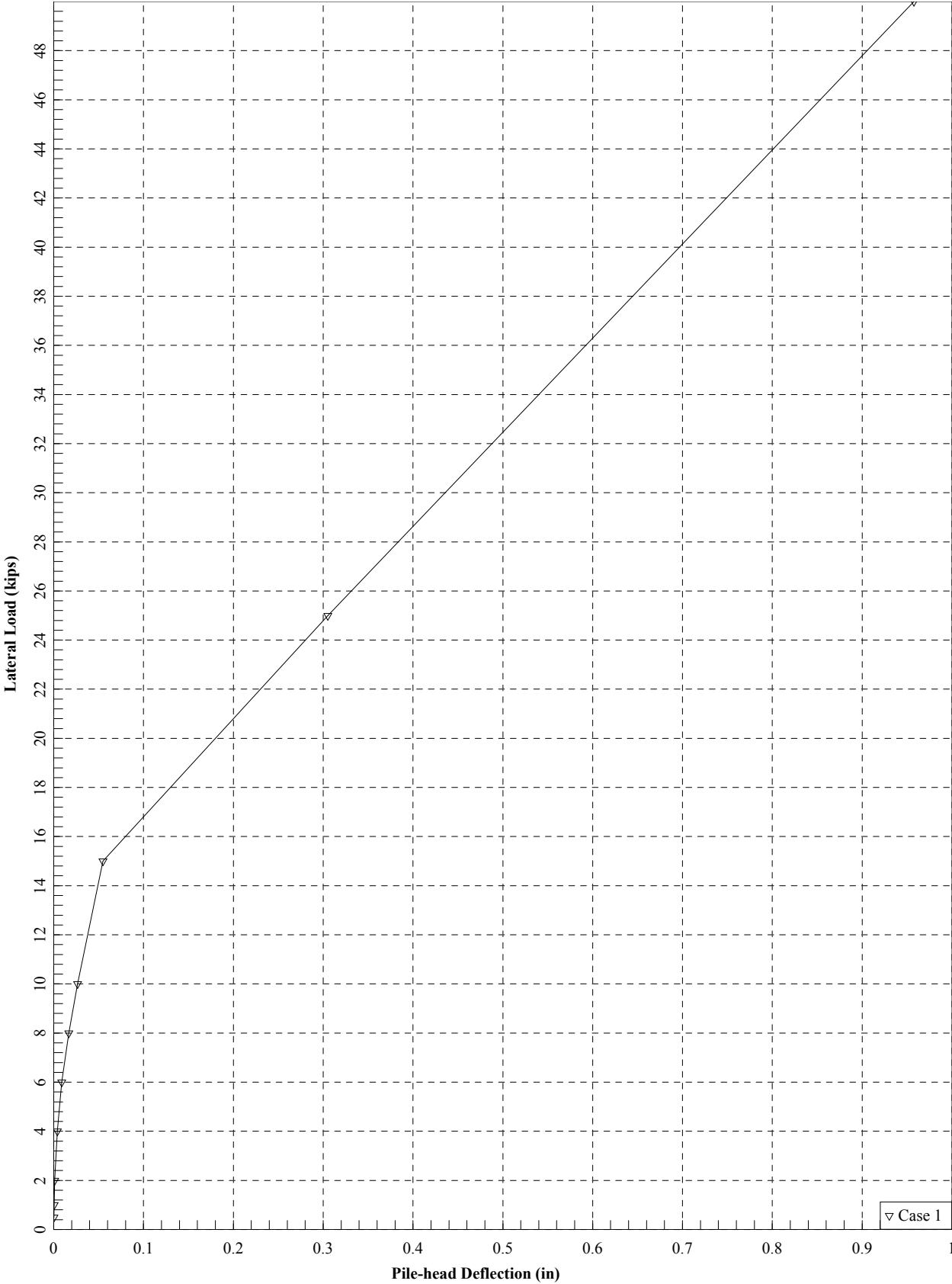


Figure 10 is a plot showing the relationship between Depth (ft) on the y-axis (ranging from 0 to 20) and normalized horizontal distance (x/B) on the x-axis (ranging from -0.1 to 0.6). The plot displays several curves representing different cases, with Case 10 (blue circles) showing the most significant horizontal displacement at depth.

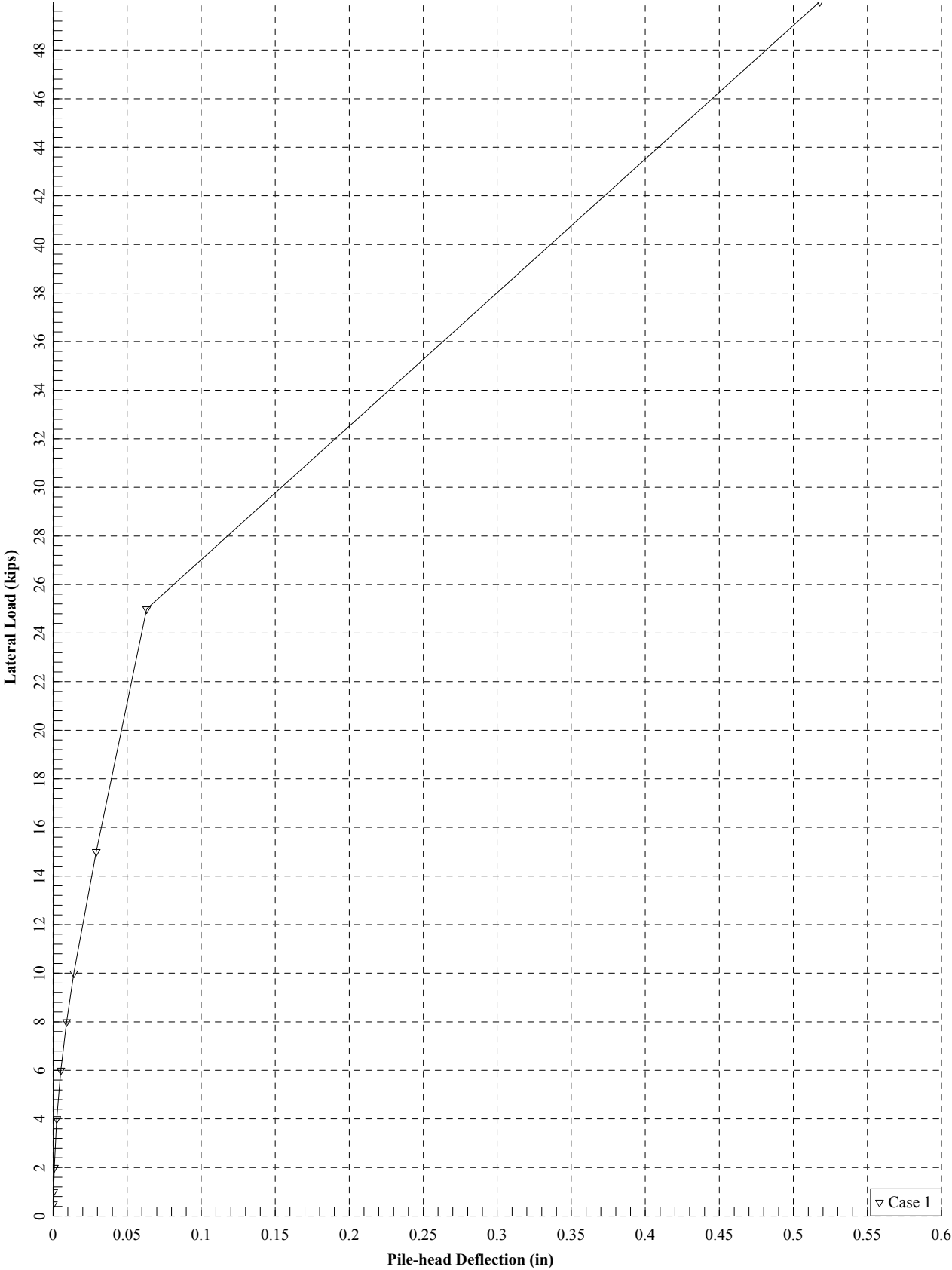
Depth (ft)	Normalized horizontal distance (x/B)
0	0.00
1	0.00
2	0.00
3	0.00
4	0.00
5	0.00
6	0.00
7	0.00
8	0.00
9	0.00
10	0.00
11	0.00
12	0.00
13	0.00
14	0.00
15	0.00
16	0.00
17	0.00
18	0.00
19	0.00
20	0.00

Figure 10 is a plot showing Depth (ft) on the vertical axis (ranging from 0 to 20) versus a horizontal axis (ranging from -140 to 40). The plot displays ten cases, each represented by a different color and marker shape. The cases are:

- Case 1: Inverted triangle (▽)
- Case 2: Square (□)
- Case 3: Triangle (△)
- Case 4: Diamond (◇)
- Case 5: Circle with dot (⊙)
- Case 6: Circle with cross (⊗)
- Case 7: Circle with plus (⊕)
- Case 8: Circle with asterisk (⊛)
- Case 9: Circle with x (⊗)
- Case 10: Circle with dot (⊙)

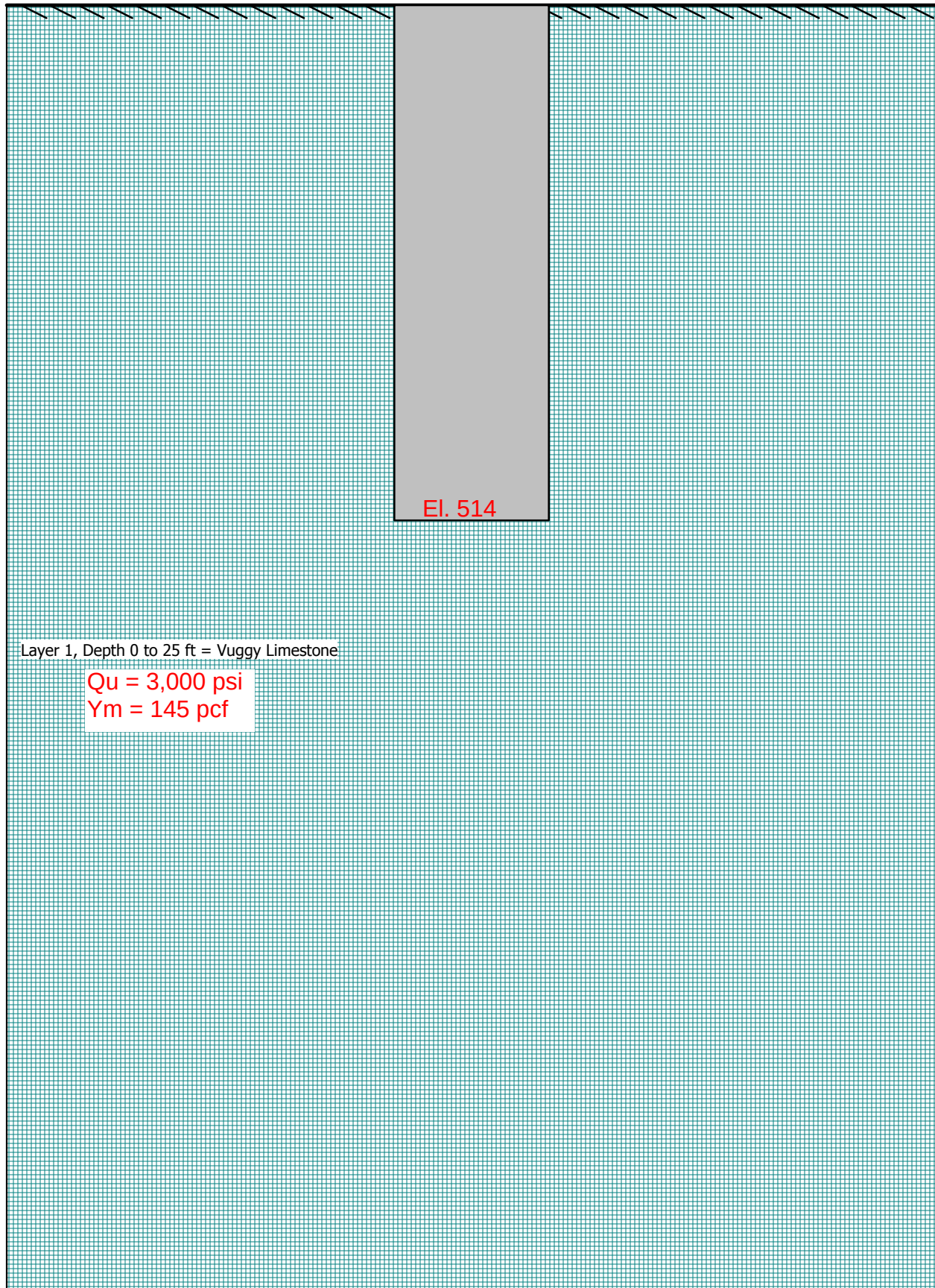
The plot shows that all cases converge to a single profile at the surface (0 ft depth). The profiles for Cases 2 through 10 are very similar, showing a sharp increase in the horizontal axis value as depth increases. Case 1 is a horizontal line at approximately -100.

SCIENCE BUILDING: 36-INCH DIAMETER DRILLED SHAFT

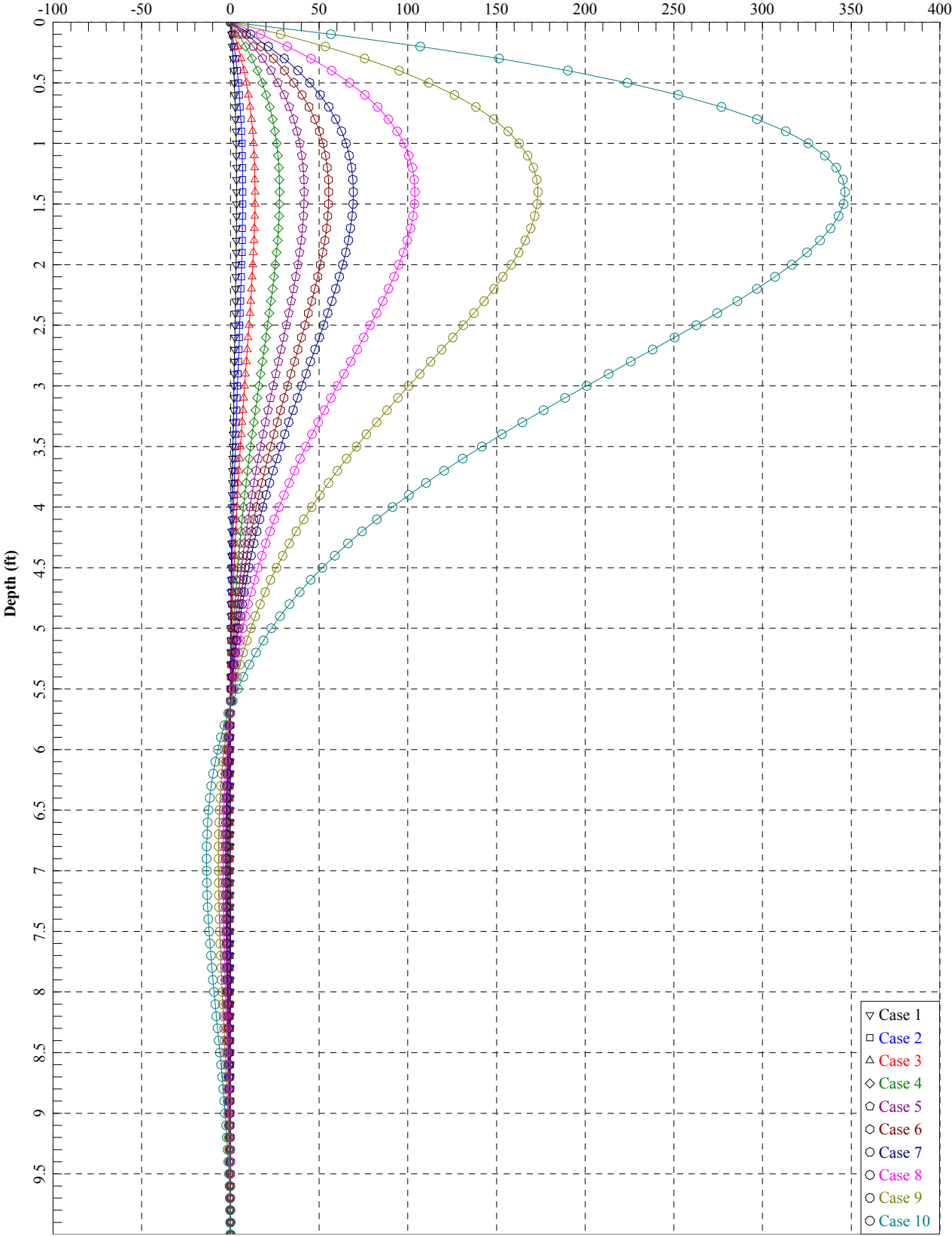


DRILLED SHAFT - SOIL PROFILE [NO OVERBURDEN]

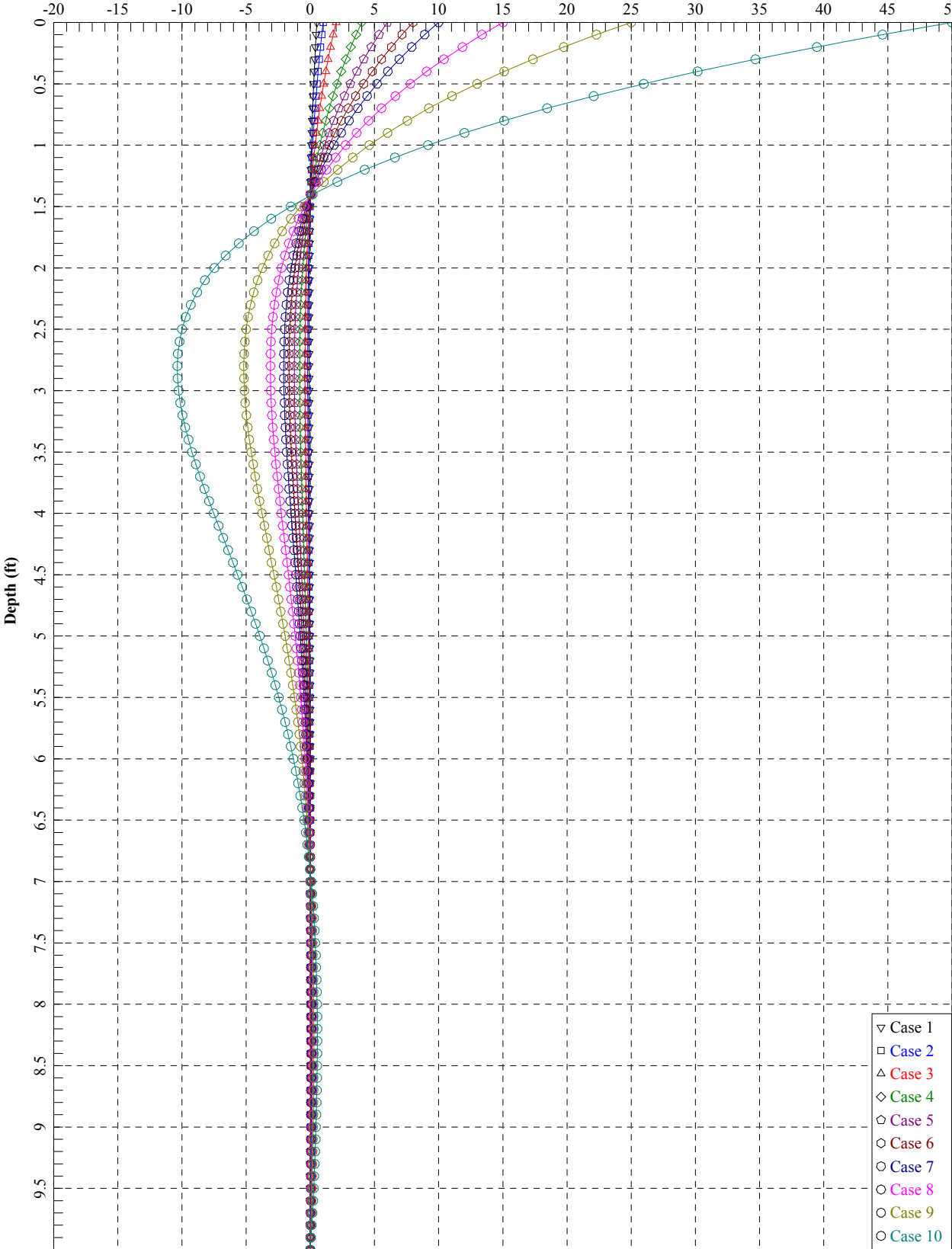
El. 524



SCIENCE BUILDING: 30-INCH DIAMETER DRILLED SHAFT
Bending Moment (in-kips)



SCIENCE BUILDING: 30-INCH DIAMETER DRILLED SHAFT
Shear Force (kips)



SCIENCE BUILDING: 30-INCH DIAMETER DRILLED SHAFT

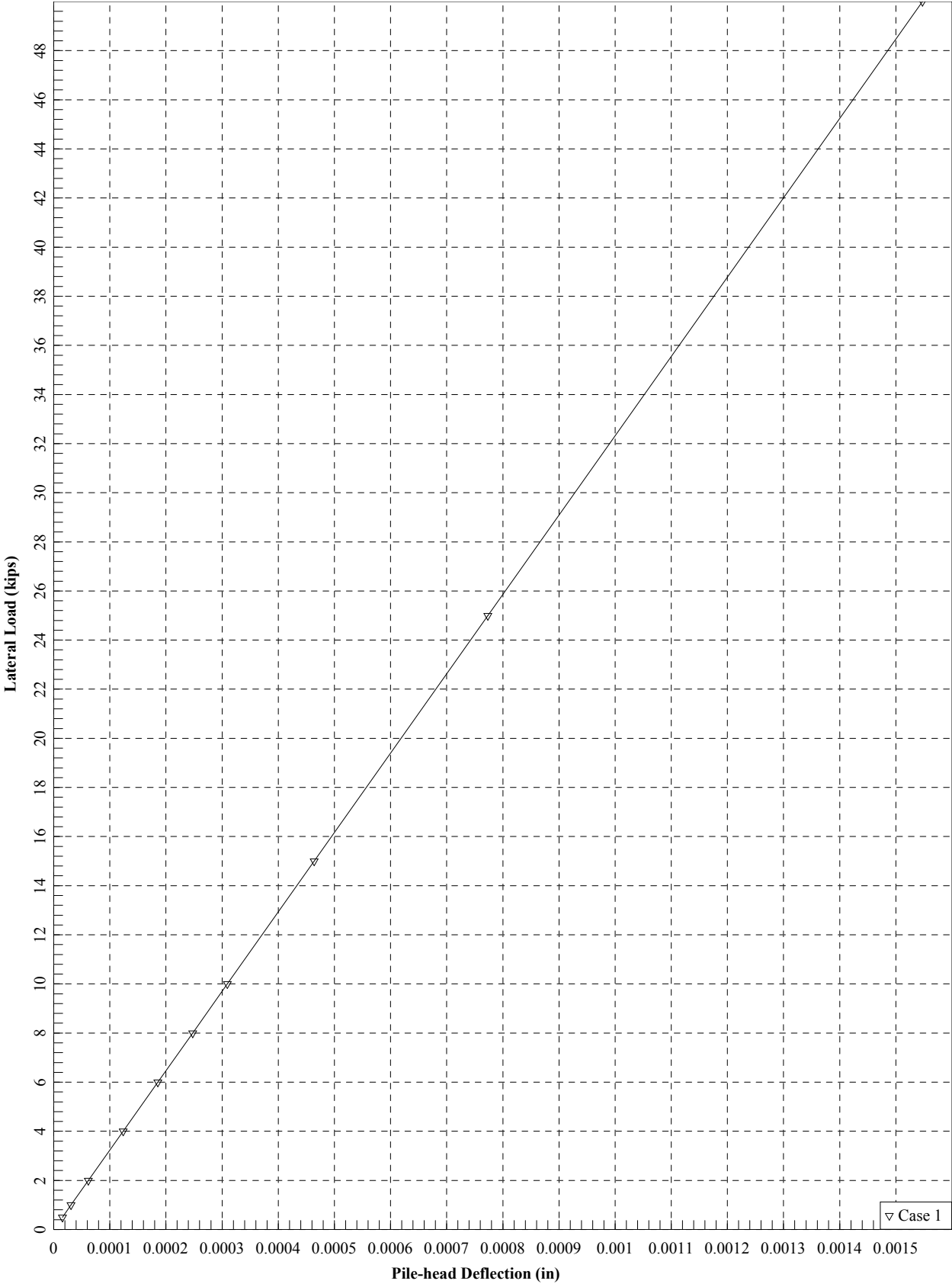
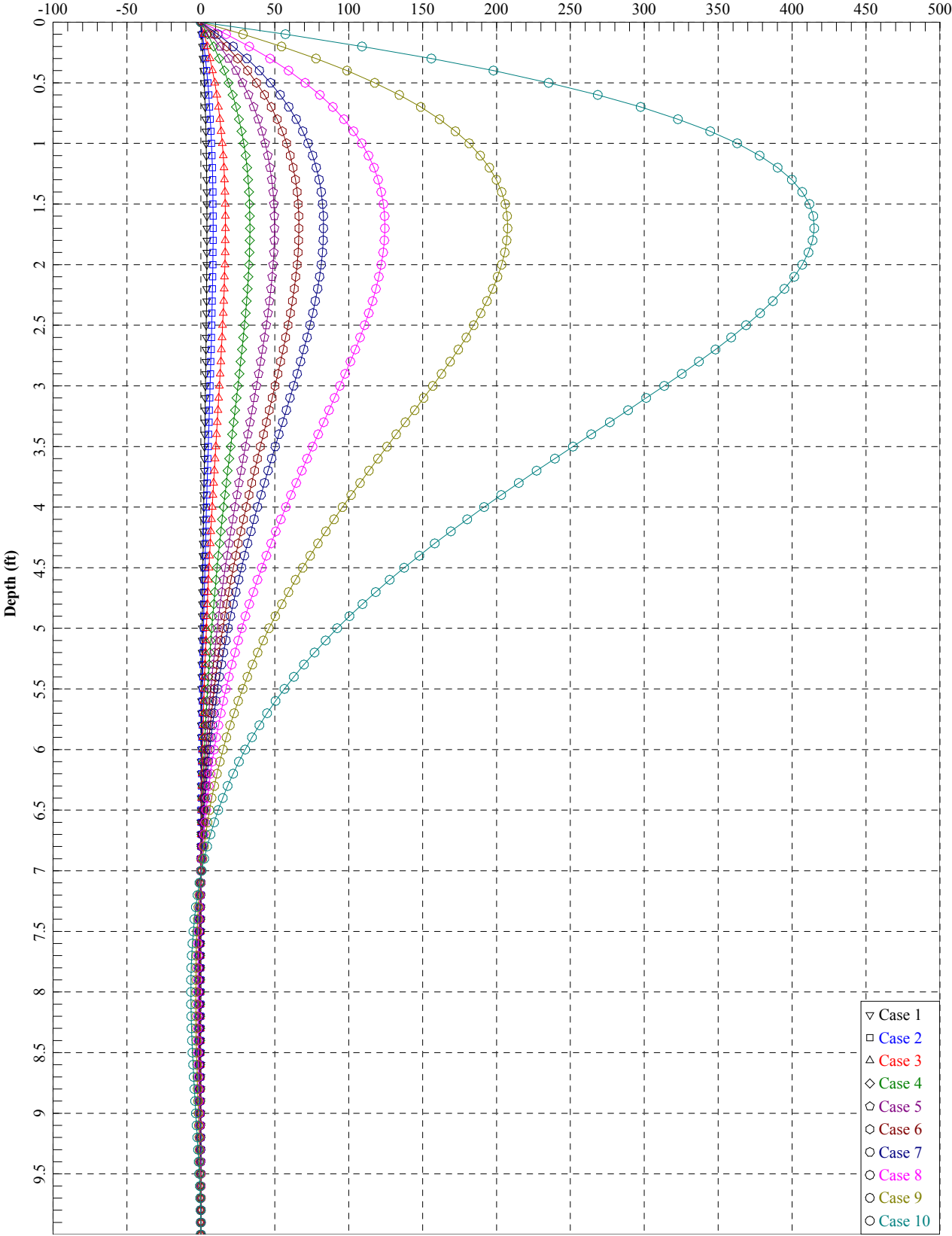
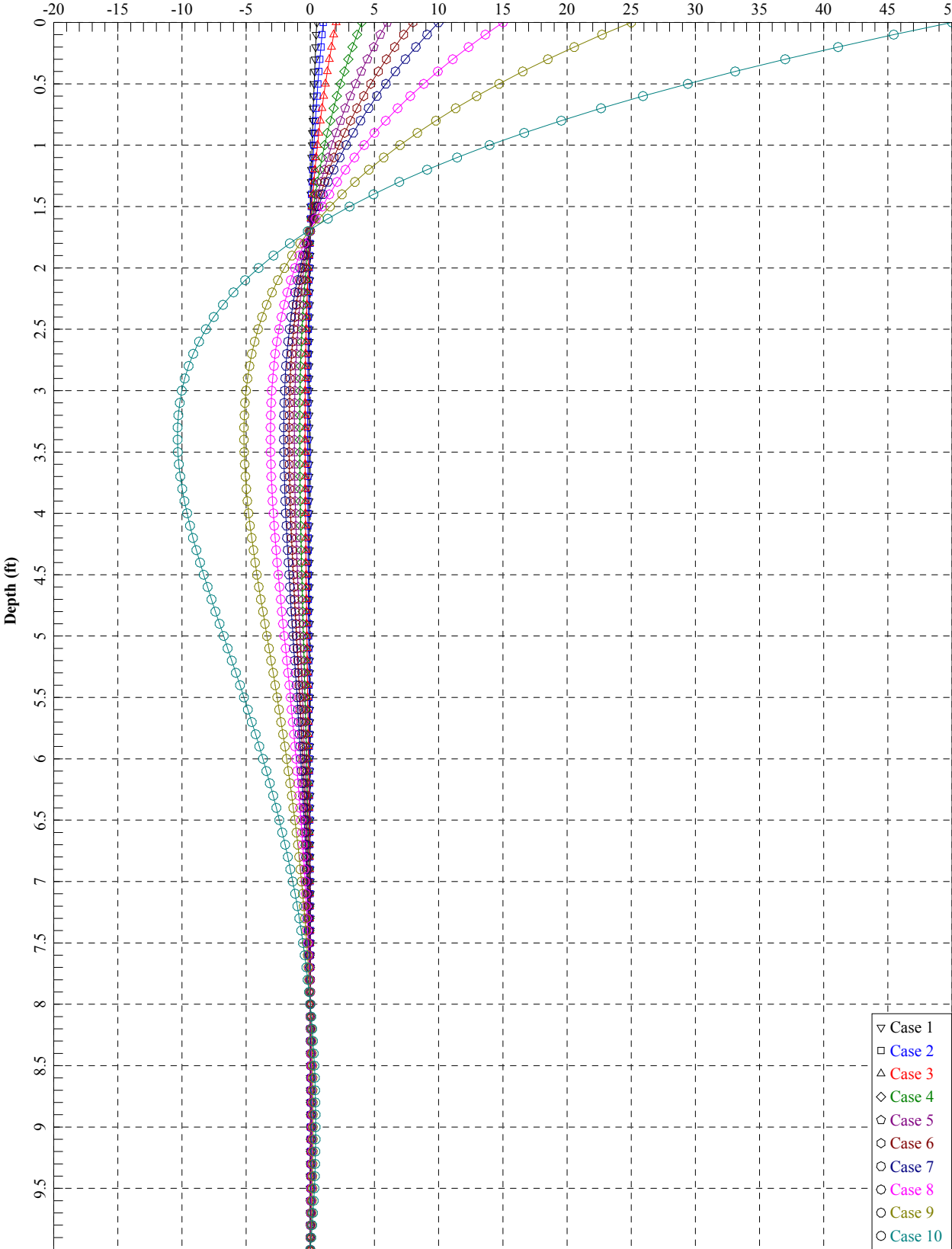


Figure 10 is a plot of Depth (ft) versus normalized time t/τ_0 . The y-axis represents Depth in feet, ranging from 0 to 9.5. The x-axis represents normalized time t/τ_0 , ranging from 0 to 0.012. The plot shows ten curves, each corresponding to a different case, with markers indicating data points. The curves generally show an increase in depth over time, with Case 10 (red circles) showing the highest depth values and Case 1 (black inverted triangles) showing the lowest depth values.

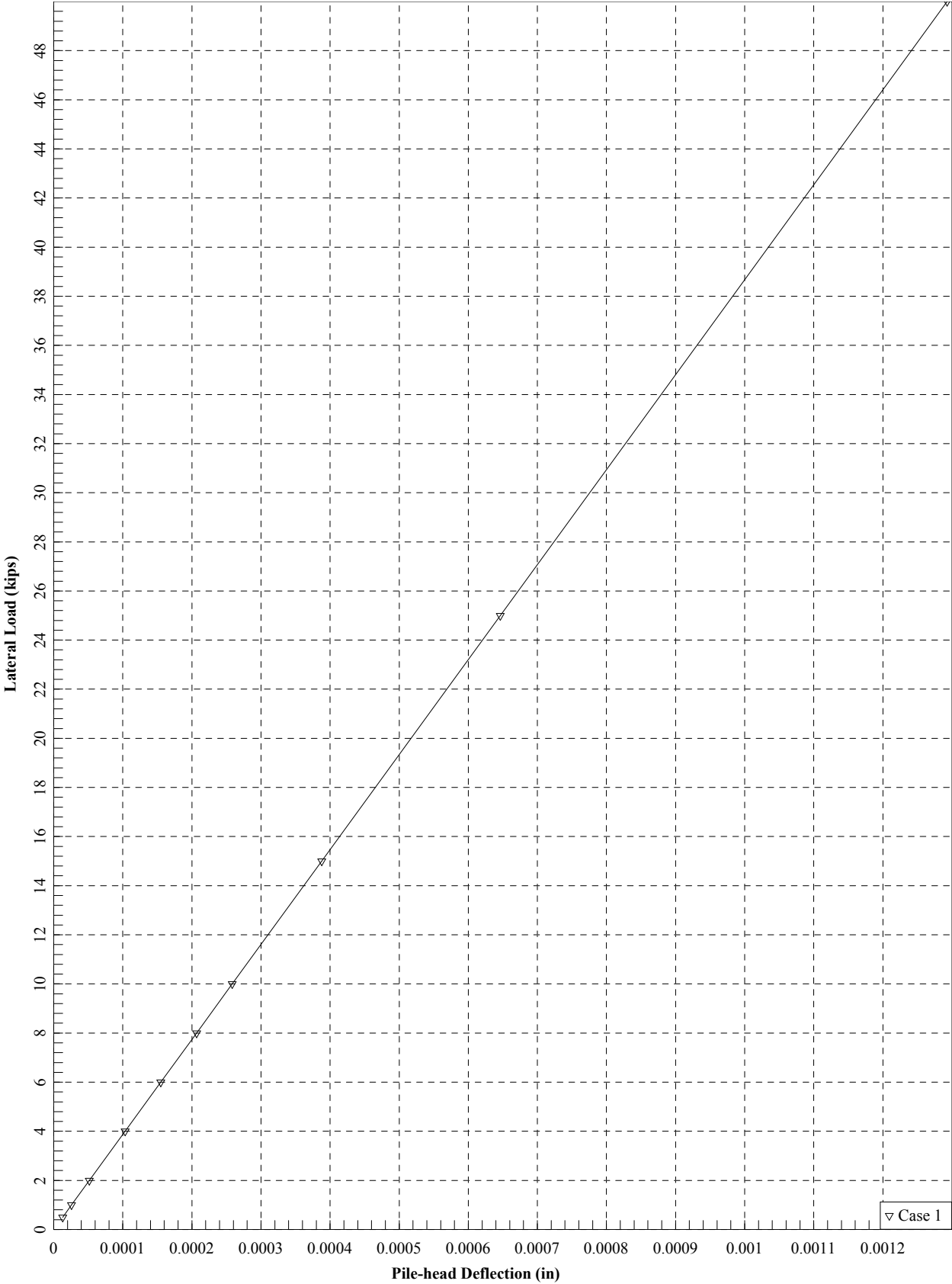
SCIENCE BUILDING: 36-INCH DIAMETER DRILLED SHAFT
Bending Moment (in-kips)



SCIENCE BUILDING: 36-INCH DIAMETER DRILLED SHAFT
Shear Force (kips)



SCIENCE BUILDING: 36-INCH DIAMETER DRILLED SHAFT



SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for unit prices.

1.2 DEFINITIONS

- A. Unit price is a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent entity acceptable to Contractor.
- D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

	Description	Add	Deduct	Unit
Unit Price #1	Mass rock removal – breaker	Add \$	Deduct \$	Cubic yard
Unit Price #2	Mass rock removal – ripable	Add \$	Deduct \$	Cubic yard
Unit Price #3	Trench rock removal – breaker	Add \$	Deduct \$	Cubic yard
Unit Price #4	Trench rock removal – ripable	Add \$	Deduct \$	Cubic yard
Unit Price #5	Hand removal of rock	Add \$	Deduct \$	Per hour
Unit Price #6	Third party opinion of rock classification	Add \$	Deduct \$	Cubic yard

**Interdisciplinary Science Building
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Cannon Design Project No. 004561.01**

Unit Price #7	Select borrow earth fill, placed and compacted (measured in place)	Add \$	Deduct \$	Cubic yard
Unit Price #8	Structural granular fill – placed and compacted (measured in place)	Add \$	Deduct \$	Cubic yard
Unit Price #9	Unsuitable material excavation, legally disposed off site (measured in place)	Add \$	Deduct \$	Cubic yard
Unit Price #10	Engineered fill in place – granular	Add \$	Deduct \$	Cubic yard
Unit Price #11	Engineered fill in place – soil	Add \$	Deduct \$	Cubic yard
Unit Price #12	Additional topsoil from off-site spread in place (truck measure)	Add \$	Deduct \$	Cubic yard
Unit Price #13	Furnish rock, spread and rolled	Add \$	Deduct \$	Ton
Unit Price #14	Siltation control fence	Add \$	Deduct \$	Linear foot
Unit Price #15	Increased or decreased pier depth for 30 inch pier	Add \$	Deduct \$	Linear foot
Unit Price #16	Increased or decreased pier depth for 36 inch pier	Add \$	Deduct \$	Linear foot
Unit Price #17	Increased or decreased pier depth for 42 inch pier	Add \$	Deduct \$	Linear foot
Unit Price #18	Adding or removing concrete for piers depending on depth	Add \$	Deduct \$	Cubic yard
Unit Price #19	More or less reinforcing steel for 30 inch pier	Add \$	Deduct \$	Pound
Unit Price #20	More or less reinforcing steel for 36 inch pier	Add \$	Deduct \$	Pound
Unit Price #21	More or less reinforcing steel for 42 inch pier	Add \$	Deduct \$	Pound

END OF SECTION 012200

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - 2. Submit the Schedule of Values to Architect through Construction Manager at earliest possible date but no later than fifteen days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 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. Arrange Schedule of Values consistent with format 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 multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum and subcontract amount.
 - a. Include separate line items under Contractor and principal subcontracts for LEED documentation and other Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 - 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. 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.
- 8. 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.
- C. Substantiation of Values: Upon Architect's request, submit sufficient data to substantiate the values stated in the Schedule of Values.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager 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: Submit Application for Payment to Architect by the 5th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 - 4. Each item listed in the Payment Application shall have a separate amount for labor, a separate amount for material costs, and a separate amount for other costs.
 - 5. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.

- c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Claims for Additional Time: Any claims for additional time and/or delays shall be made during the pay application period when the delay is being claimed.
 - 1. 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.
- G. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- I. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of Values.
 - 3. Contractor's Construction Schedule (preliminary if not final).
 - 4. Products list (preliminary if not final).
 - 5. Submittals Schedule (preliminary if not final).
 - 6. List of Contractor's staff assignments.
 - 7. List of Contractor's principal consultants.
 - 8. Copies of building permits.
 - 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 - 10. Initial progress report.
 - 11. Report of preconstruction conference.
 - 12. Certificates of insurance and insurance policies.
 - 13. Data needed to acquire Owner's insurance.

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14. Initial settlement survey and damage report if required.
- K. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment 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.
- L. 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. Evidence that claims have been settled.
 7. 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.
 8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.

1.2 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.3 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and 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.
- B. No claim for delay shall be allowed on account of failure of the Architect to furnish Drawings, Specifications or instructions or to return Shop Drawings or Samples until 15 days after receipt by the Architect by registered or certified mail of written demand for such instructions, Drawings, or Samples, and not then unless such claim be reasonable.
- C. Priority of Construction Space:
 - 1. Coordinate installation of different components to ensure performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

2. Following is the Order of Priority of construction space:
 - a. First: Ductwork.
 - b. Second: Fire protection piping.
 - c. Third: Other piping.
 - d. Fourth: Conduit.
 - D. Condition of Contract Drawings for Mechanical and Electrical Work:
 1. Drawings contain diagrammatic layouts and indicate general arrangement of systems, piping conduit, etc.
 2. Prior to installation of material and equipment, review and coordinate Work with Architectural and Structural Drawings for exact space conditions; where not readily discernable request information from Architect before proceeding.
 3. Check Drawings of all other trades to verify extent of material and equipment to be installed in spaces available and consider layout alternatives so that all requirements can be accommodated.
 4. Maintain maximum headroom at all locations without finished ceilings.
 5. Maintain finished ceiling heights as indicated.
 6. Coordinate installations with other trades to prevent conflict with Work of other trades and cooperate in making reasonable modifications in layout as needed.
 7. Where conflicts occur with placement of mechanical and electrical materials as they relate to placement of other building materials, the Construction Manager shall be consulted for assistance in coordination of the available space to accommodate all trades.
 - E. 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.
 - F. 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.
- 1.4 COORDINATION DRAWINGS
- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Areas of Work requiring Coordination Drawings include (but are not limited to) mechanical rooms, electrical rooms, equipment rooms, corridors, horizontal exits from duct shafts, cross-over's and any other area where congestion of Work occurs. Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
 2. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data or reproductions of the Contract Documents which in their original, copied or electronic file form are the Architect's instrument of service and are protected under copyright laws. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Follow routing shown on Contract Drawings for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.
 - d. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - e. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - f. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - g. Indicate required installation sequences.
 - h. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 - i. Refer to individual Sections for additional requirements for Coordination Drawings specific to that Section.
 3. Do not begin fabrication until receipt of completed Coordination Drawings is acknowledged by the Construction Manager in writing to the Architect.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Preparation Format: Version 3D BIM in REVIT 2015 or 3D Autodesk 2015, operating in Microsoft Windows operating system.
 3. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format from 3D BIM file.
 4. BIM File Incorporation: Construction Manager will incorporate Contractor's coordination drawing files into Building Information Model established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. If the Contract Documents are not in concurrence regarding the quantity or quality of products, the Contractor shall request interpretation from the Architect. If the contractor fails to make such a request, it is presumed that both provisions were included in the Contractor's Bid and the Architect shall determine which of the conflicting requirements shall govern. The Contractor shall perform the Work at no additional cost to the Owner in accordance with the Architect's determination.

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- B. Prior to submitting each RFI, the Contractor shall first carefully study and compare the Contract Documents, field conditions, other Owner provided information, Contractor prepared Coordination Drawings, and prior Project correspondence and documentation to determine that the information to be requested is not reasonably obtainable from such sources.
- C. Immediately on discovery of the need for additional information or interpretation of the Contract Documents and it is not possible to request information at Project meetings, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor 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.
 - 3. Frivolous RFIs: The Contractor will compensate the Owner for the Architect's time and expenses to process RFIs resulting from the Contractor's lack of studying and comparing the Contract Documents, coordinating their own Work, or repeating previous RFIs.
- D. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Contractor.
 - 5. Name of Architect and Construction Manager.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 12. Contractor's signature.
 - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- E. RFI Forms: Each RFI shall e-mailed (e-mail address will be provided) to Cannon's Construction Administration Department. RFI'S must be in an editable format. Attachments to the RFI are to be scanned and provided as part of the RFI. Each RFI is to be sequentially numbered. Each RFI shall identify the specific sources which were reviewed by the effort to determine the information requested, and a statement to the effect that the information being requested could not be determined from such sources
 - 1. Identify each page of attachments with the RFI number and sequential page number.
- F. Architect's and Construction Manager's Action: The Contractor shall submit each RFI sufficiently in advance of the date by which such information is required in order to allow the Architect sufficient time, in the Architect's professional judgment, to permit adequate review and response and to permit Contractor compliance with the latest construction schedule. Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
 - 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.

- b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of requested additional information.
 - 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 the General Conditions of the Contract for Construction.
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response in accordance with provisions in the General Conditions of the Contract for Construction.
 - G. RFI Log: The Contractor shall maintain a log at the Project site that lists each sequentially numbered RFI. This log shall contain the Drawing reference or Specification section to which the request pertains, the date of the request, to whom the request was made, by whom the request was made, the nature of the request, and the Architect's resolution thereof. This log shall be reviewed at each Project meeting and the status of the requests for information shall be made part of the minutes of such meetings. Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect and Construction Manager.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's and Construction Manager's response was received.
 - H. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.
 - 1. Identify related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- 1.6 PROJECT MEETINGS
- A. General: Construction Manager will 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 and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
 - 4. Decisions and interpretations given by the Architect and Construction Manager at Project meetings shall be on behalf of the Owner and shall be conclusive on each Contractor affected.

- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement at the Project site or another location convenient to the Owner and Architect.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - 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 communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for 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 building.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.
 - z. Progress cleaning.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Scheduling: Schedule preinstallation conferences on same day as progress meetings attended by Architect.
 2. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 3. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.

- e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
- 4. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 5. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 6. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.

- m. Responsibility for removing temporary facilities and controls.
 - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Construction Manager will conduct progress meetings at weekly intervals.
 - 1. Attendees: In addition to representatives of Owner and Architect, 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to 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) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of proposal requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
 - 3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - 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.
- F. Coordination Meetings: Construction Manager will conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

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1. Attendees: In addition to representatives of Owner and Architect, 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 meetings 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. Schedule Updating: 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) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site utilization.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) 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)

Attachments

Request for Information (RFI) Form (SAMPLE)

END OF SECTION 013100

REQUEST FOR INFORMATION No. _____

Subject:

To: Cannon Design
Attention: **Melissa Pirtle**
Email: **stl-cac@cannondesign.com**
Discipline:

Contractor:
Fax:

Specification Section No. & Paragraph:
Drawing and Details Affected:

REQUEST:

List Attached Referenced Documents:

ARCHITECT'S RESPONSE:

This information is provided as an interpretation of the Contract Documents for implementation. It is not an authorization for change to the Contract Sum or Contract Time. If this information results in a claim for a change to the Contract, the Contractor shall notify the [Construction Manager][Architect] of a change through the change process.

CONTRACTOR'S REPRESENTATION:

Undersigned warrants that Contractor has thoroughly researched the documents, and the information requested does not exist or cannot be ascertained from the information given in the documents.

Contractor's Signature: _____ Date: _____

Architect's Signature: _____ Date: _____

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Material location reports.
 - 4. Site condition reports.
 - 5. Special reports.

1.2 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. Event: The starting or ending point of an activity.
- D. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- E. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Contractor's Construction Schedule: Submit initial schedule, large enough to show entire schedule for entire construction period.

1. The Progress Schedule shall be based on an orderly progression of the Work, allowing adequate time for each operation (including adequate time for submission and review of submittals), and leading to a reasonable certainty of Substantial Completion by the date established in the Agreement. The Progress Schedule will be reviewed by the Architect for compliance with the requirements of this Article and will be accepted by the Architect or returned to the Contractor for revision and re-submittal. Unless specifically required by law, no payment under this Contract shall be due until the Progress Schedule has been approved by the Architect.
 2. Submit working electronic copy of schedule, using software indicated, labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- C. Construction Schedule Updating Reports: Submit with Applications for Payment.
- D. Material Location Reports: Submit at monthly intervals.
- E. Site Condition Reports: Submit at time of discovery of differing conditions.
- F. Special Reports: Submit at time of unusual event.
- G. Qualification Data: For scheduling consultant.
- 1.4 QUALITY ASSURANCE
- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 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 work stages, area separations, interim milestones, and partial Owner occupancy.
 4. Review delivery dates for Owner-furnished products.
 5. Review schedule for work of Owner's separate contracts.
 6. Review submittal requirements and procedures.
 7. Review time required for review of submittals and resubmittals.
 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 10. Review and finalize list of construction activities to be included in schedule.
 11. Review submittal requirements and procedures.
 12. Review procedures for updating schedule.
- 1.5 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 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. 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.
- B. Activities: Treat each story 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. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 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 15 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.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. 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. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work under More Than One Contract: Include a separate activity for each contract.
 - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 - 7. 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.

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- 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.
- 8. 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.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- E. Cost Correlation: Superimpose a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
 - 1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.
 - 2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - 3. Each activity cost shall reflect an accurate value subject to approval by Architect.
 - 4. Total cost assigned to activities shall equal the total Contract Sum.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using dragnets to demonstrate the effect of the proposed change on the overall project schedule.

- I. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

- A. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
 1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request For Interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Actual Completion percentage for each activity.

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- B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final Completion construction photographs.

1.2 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.
- B. Construction Digital Photographs: Submit image files within three days of taking photographs.
1. Digital Camera: Minimum sensor resolution of 8 megapixels.
 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file. Submit files on CD-ROM or DVD.
 3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect and Construction Manager.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.3 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
1. Maintain key plan with each set of construction photographs that identifies each photographic location.

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- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in filename for each image.
 - 2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect and Construction Manager.
- C. Preconstruction Photographs: Before commencement of excavation, take black-and-white color photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 2. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken. Architect will inform photographer if pre-selected vantage points are to be used.
- E. Architect- Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.
 - 1. Do not include date stamp.
- G. Additional Photographs: Architect or Construction Manager may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum or in the allowance for construction photographs.
 - 1. Three days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
 - 1. Required Submittals: All required submittals are indicated in each specification section. Do not submit items unless they are required by Specification Section. Submittals which are not required may be discarded without review.
 - 2. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager 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 and Construction Manager'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.
- 5. The Architect reserves the right to hold all submittals until a complete submittals schedule has been submitted and approved.
 - 6. Package submittals by specification section, except closeout submittals or Work performed by separate trades, in a single delivery to the Architect; failure of the Contractor to package these submittals in a single delivery may cause the Architect to withhold action on submittal(s) until associated submittal(s) required by the particular specification section are received.
 - 7. The review of any submittal without the submission and approval of a submittal schedule does not relieve the Contractor of his responsibility to provide this action submittal for approval. Failure to comply with this action submittal will relieve the Architect of all constraints on review periods.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Prior to generating shop drawings and constructing mock ups, Construction Manager shall coordinate and conduct a job site meeting between all exterior envelope installer's, the Owner and the Architect. The purpose of this meeting is to discuss the relationship between all components and to ensure proper coordination between all trades involved. Each Contractor involved in the building envelope, from exterior sheathing and roof deck outward, shall be prepared to demonstrate a thorough knowledge of the documents and be prepared to discuss their transitions with other materials.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals. For samples and required paper submittals, review time will begin when both the physical submittal and the electronic Submittal Identification Sheet have been received by the Architect.

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1. Initial Review: Allow sufficient time for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow sufficient time for review of each resubmittal.
 3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow sufficient time for initial review of each submittal.
 4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow sufficient time for review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.
- E. Paper and Sample Submittals: Place a permanent label or title block on each submittal item for identification
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Transmittal for Paper and Sample Submittal: All submittals shall be accompanied by a completed Submittal Identification Sheet in the form of the sample found at the end of this Section. Submittals lacking this sheet will not be reviewed.
- F. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier, Specification Section number, and item number, followed by REV and the number of the review, then the title. (eg. "PI-05 5100-001 Rev 01 SD-Metal Stairs – Stair 01 & 02" is the appropriate name for the first metal stair shop drawing for stair 01 and 02 review 01).
 - b. Project Identifier shall be as follows: MSMC-1A.
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use form at the end of this Section and acceptable to Architect, Owner, containing the following information (Submittals lacking this sheet will be returned as not reviewed):
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.

- r. Other necessary identification.
 - s. Remarks.
- 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
 - e. Keynote or finish code.
- G. Options: Identify options requiring selection by Architect.
- H. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
 - 1. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on submittals.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked "No Exceptions Taken" or "Make Corrections Noted" , and initialed by Architect
- J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- K. Use for Construction: Use only final submittals with mark indicating "No Exceptions Taken" or "Make Corrections Noted", and initialed by Architect.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. If the Contractor proposes to use a material which, while suitable for the intended use, deviates in any way from the detailed requirements of the Contract Documents, the Contractor shall inform the Architect in writing of the nature of such deviations at the time the material is submitted for approval, and shall request written approval of the deviation from the requirements of the Contract Documents.
- B. The accuracy of all such information is the responsibility of the Contractor. In reviewing Shop Drawings, Product Data, Samples, and similar submittals the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.
- C. General Submittal Procedure Requirements: Prepare and submit Submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

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1. Submit electronic submittals via email as PDF electronic files. E-mail files to Architect's Construction Administrator Coordinator (CAC), with CC to Owner's Representative and Architect. The subject line of the e-mail should contain the project name and the Submittal Identification Number. When files are too large for e-mail, post them to the Architect's project FTP site and e-mail the transmittal to the Architect's CAC as noted above, identifying that the submittal has been uploaded to the FTP site.
 - a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Action Submittals: Must be submitted electronically. Architect, through will return one annotated copy.
 3. Informational Submittals: Must be submitted electronically. Architect and Construction Manager will not return copies.
 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- D. 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 to Project.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications, including performance characteristics written to match specified terminology for ease of comparison.
 - c. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1) Preparation of substrates.
 - 2) Required substrate tolerances.
 - 3) Sequence of installation or erection.
 - 4) Required installation tolerances.
 - 5) Required adjustments.
 - 6) Recommendations for cleaning and protection.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring and controls.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operation and maintenance manuals.
 - k. Statement of compliance with specified referenced standards.
 - l. Testing by recognized testing agency.
 - m. Application of testing agency labels and seals.

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- n. Notation of coordination requirements.
 - o. Availability and delivery time information.
 - p. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - q. Additional information as required by Specifications.
 - 4. Submit Product Data before or concurrent with Samples.
 - 5. Submit Product Data as a pdf electronic file.
 - 6. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
 - a. Architect will not review MSDS sheets and will remove/discard them from the submittal.
- E. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not reproduce the Contract Documents, in whole or in part, for use as shop drawing backgrounds without the prior written consent of the Architect. If consent is given, the Architect shall determine the extent that the Contract Documents may be used in the preparation of shop drawings.
- 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.
 - p. Additional information as required by Specifications.
 - q. Do not include the phrase "by others," except when relating to materials, products or equipment not included under the Work of the Contract.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (750 by 1067 mm).
 - a. Submittals shall be clear and legible. The Architect reserves the right to reject in full any submittal due to illegibility, as determined solely by the Architect, without any impact to the allowed review time. All dimensions and text shall be a minimum of 10pt or 0.389 inches in height. Drawings not conforming to this requirement will be rejected without review.
 - 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.

- b. For 8 1/2 x 11 inch shop drawings in excess of 20 pages, submit two (2) full size hard copies, in addition to the electronic PDF file. Architect will return only the annotated electronic PDF file.
 - c. For 11 x 17 inch shop drawings in excess of 20 pages submit two (2) full size hard copies, in addition to the electronic PDF file. Architect will return only the annotated electronic PDF file.
 - d. For shop drawings larger than 11 x 17 inch format, submit two (2) full size hard copies, in addition to the electronic PDF file. Architect will return only the annotated electronic PDF file.
- F. 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.
 - e. Specification paragraph number and generic name of each item.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. 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 that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 5. 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. Number of Samples: Submit two (2) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return one (1) submittal set with options selected.
 - 6. 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 three (3) sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one (1) returned Sample set as a Project Record Sample.

- 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) Variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
7. Field Samples: Erect at project site at location(s) acceptable to Architect.
 - a. Construct each field sample complete; including work of all trades required to finish the Work.
 - b. When directed by Architect, demolish field sample and remove from Project Site, unless acceptable by Architect as part of the completed.
- G. Product Schedule: 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 as a PDF electronic file.
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use of CSI form 1.5A is preferred, if not used, submission must include the following information in tabular form:
 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Submit list electronically.
- J. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- M. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

- P. Contractor Certification Letter: Where specifically authorized in individual Sections, prepare written certification on Contractor's letterhead indicating that products listed in the Certification Letter will be provided as specified in the Section without modification or deviation from the Contract Documents. See Sample "Contractor's Certification Letter" attached to this Section.
1. Submission of "Contractor's Certification Letter" signifies that Contractor will provide Products and Materials as specified in PART 2 of individual Specification Sections, and negates the requirement to submit the Product Data portion of Action Submittals. However, Product Data specified as part of Operation and Maintenance Data shall be submitted as specified in the Specification Section.
- Q. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
 2. Date of evaluation.
 3. Time period when report is in effect.
 4. Product and manufacturers' names.
 5. Description of product.
 6. Test procedures and results.
 7. Limitations of use.
- U. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- V. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- Z. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

- AA. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service 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.
- BB. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

2.2 DELEGATED DESIGN

- 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 Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of a statement, 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.
- C. Structural Engineering and Deferred Approval Submittal Procedures.
1. Prepare submittal documentation under the provisions of Section 013300.
 - a. Clearly identify all deviations and proposed alternates to materials and systems specified in this Project Manual.
 2. Progress Submittal: Provide progress submittal to Architect approximately 4 weeks prior to initial submittal, including the following components:
 - a. Narrative reflecting an understanding of the basis of design for the curtainwall assembly, including structural and thermal performance.
 - b. Shop drawings showing critical details.
 - c. Calculations for preliminary anchorage details.
 - d. Proposed list of initial submittal documents.
 - e. Engineers qualifications.
 - f. The documents will be reviewed by Architect for consistency with specified criteria. Corrections, if any, will be identified and returned to Contractor.
 3. Provide structural analysis, calculations, drawings, specifications, and all other documents required for linear ceiling anchored to support framing. Documents shall be signed and sealed by the Florida licensed Structural Engineer responsible for their preparation.
 4. Submittal Process:

- a. The submittal will be reviewed by Architect for consistency with specified criteria. Corrections, if any, will be identified and returned to Contractor.
- b. Contractor shall make corrections and return to Architect within one week of receipt.
- c. No contract time extensions will be granted for document modification caused by non-conformance with specified criteria.
- d. Mark all submittals with licensed structural engineer's signature and stamp.
- e. Stamp and sign all Submittals by a licensed Structural Engineer in the State of Florida.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: 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. Mark with approval stamp before submitting to Architect and Construction Manager.
 1. Verify:
 - a. Field Measurements.
 - b. Field Construction Criteria.
 - c. Catalog Numbers and Similar Data.
 - d. Quantities.
 2. Contractor's responsibility regarding errors and omissions in submittals is not relieved by Architect's and Construction Manager's review of submittals.
 3. Contractor's responsibility regarding deviations in submittals from requirements of Contract Documents is not relieved by Architect's and Construction Manager's review of submittals, unless Architect gives written acceptance of specific deviations as approved by Owner.
 4. When work is directly related and involves more than one trade, coordinate submittal with other trades and submit under one cover.
 5. After a submittal has been submitted for review, no changes may be made to that Submittal other than changes resulting from review notes made by the Architect and Construction Manager unless such changes are clearly identified and circled before being resubmitted. Any failure to comply with this requirement shall nullify and invalidate the Architect's and Construction Manager's review.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal identification sheet with Contractor's stamp certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

- A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 1. Stamped Reviewed "No Exceptions Taken":

- a. No corrections or resubmissions required, fabrication may proceed.
 - 2. Stamped Reviewed "Make Corrections Noted":
 - a. If Contractor complies with noted corrections, fabrication may proceed and resubmission is not required, unless otherwise noted.
 - b. If for any reason the Contractor cannot comply with the noted corrections, fabrication shall not proceed and Contractor shall resubmit, following procedures outlined hereinbefore.
 - 3. Stamped Reviewed "Revise and Resubmit":
 - a. Contractor shall revise and resubmit for review. Fabrication shall not proceed.
 - 4. Stamped "Rejected":
 - a. Submittal is not in compliance with the Contract Documents, and is not acceptable. Resubmit Contract compliant material.
 - 5. Stamped "For Record Only":
 - a. Submittal has been received and will be retained for record keeping purposes.
 - C. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.
 - D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
 - E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
 - F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
- 3.3 DISTRIBUTION OF SUBMITTALS BY ORIGINAL SUBMITTER, AFTER ARCHITECT'S REVIEW
- A. Make and distribute copies of submittal which have been accepted by the Architect to the following:
 - 1. Construction Manager.
 - 2. Contractor.
 - 3. Related Contractor(s).
 - 4. Supplier.
 - 5. Fabricator.
 - 6. Owner's representative.
 - 7. Job-site file (record copy).
 - B. Produce and distribute additional copies as required.

END OF SECTION 013300

SUBMITTAL IDENTIFICATION SHEET

To be completed by Contractor/CM

PROJECT NAME	
ADDRESS	
NUMBER	
OWNER	
ARCHITECT / ENGINEER	
SUBMITTED BY	
CONTRACTOR / CM SUBMITTAL NO.	CANNON DESIGN SUBMITTAL NO.
DRAWING / DETAIL REFERENCE	SPECIFICATION SECTION / PARAGRAPH
MANUFACTURER / SUPPLIER	ITEM / PRODUCT ID
REQUIRED DATE	PRIORITY
CRITICALITY	

To be completed by Reviewer

CANNON DESIGN SUBMITTAL NUMBER
RECEIVED DATE

- ☐ **A. No Exceptions Taken**
No further review of submittal is required.
- ☐ **B. Make Corrections Noted**
Incorporate corrections in work;
resubmission is not required.
- ☐ **C. Revise and Resubmit**
Revise as noted, and resubmit for review.
- ☐ **D. Rejected**
Submittal is not in compliance with Contract Documents;
provide new submittal.
- ☐ **E. For Record / Information Only**
Submittal was reviewed for Record / Information
purposes only.
- ☐ **F. Not Required for Review**
Submittal is not required by Contract Documents
and has not been reviewed.

Review is for conformance with the design concept of this project and for general compliance with contract documents. Contractor is responsible for quantities, dimensions and compliance with contract documents and for information that pertains to fabrication processes, construction techniques and coordination of this work with all trades which will be affected thereby. This review is null and void if submittal deviates from contract documents and does not indicate or note deviations.

ITEM BEING SUBMITTED (check only one)

- ☐ Shop Drawings ☐ Certification / Qualifications ☐ Coordination Drawing
☐ Samples ☐ Record Documents ☐ Calculations
 (_____ copies) ☐ Product Data ☐ Schedules
☐ LEED Submittal ☐ O&M Manuals
☐ Other

ITEM BEING SUBMITTED FOR (check only one)

- ☐ Action ☐ Information Only ☐ Record

REMARKS OR DEVIATIONS

CONTRACTOR / CM CERTIFICATION
(SUBMITTALS NOT CERTIFIED WILL BE RETURNED WITHOUT REVIEW)

REVIEWED BY	DATE

A/E COMMENTS

- ☐
- See attached sheet(s) for additional comments

REVIEWED BY	DATE

(Contractor's typical letterhead format is preferred)

Contractor Name/Address

Date:

Re: Cannon Design Project Name: Maryland Heights Community Center
Cannon Design Project No.: 004036.01

I certify that the manufacturer and products listed below are specified by the Contract Documents and will be provided per manufacturer's recommendations and per Contract Documents. This materials certification is in lieu of submitting any further shop drawing/submittal documentation for this particular product.

(Example):

Specification Section: 09 2900 – Gypsum Board
Paragraph Number: 2.2 A.2 Interior Gypsum Board
Manufacturer: National Gypsum Company
Manufacturer's
Product Designation: Gold Bond Fire-Shield Gypsum Board

*(Several Specification Sections/Products can be listed on single Certification Letter.
Applicable to Specification Section that requires certifications only.)*

Specification Section: _____

Paragraph Number: _____

Manufacturer: _____

Manufacturer's Product
Designation: _____

Specification Section: _____

Paragraph Number: _____

Manufacturer: _____

Manufacturer's Product
Designation: _____

Contractor's Signature
and Date: _____

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 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. Services of testing laboratories and Special Inspectors as specified are intended for the Owner's verification of the Contractor's compliance with the requirements of the Contract Documents. 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 or relieve the Contractor of the responsibility for compliance with the Contract Document requirements.
 - 4. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
 - 5. The services and quantities of testing specified are approximate and may vary. Actual services and quantities of testing will be determined by the Owner, and/or Architect, and/or Construction Manager during the construction period.
 - 6. Specific test and inspection requirements are not specified in this Section.

1.2 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 constructed 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; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

~~1. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.~~

~~2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.~~

~~3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.~~

- 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.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

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

1.4 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior ~~laboratory~~ mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.5 INFORMATONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. Testing Agency Qualifications: 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.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 - 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

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.
 5. Other required items indicated in individual Specification Sections.
- D. 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.

1.8 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, 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.
- 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 products 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. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. 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.
- J. 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.
 - g. When requested by the Architect, Construction Manager, testing agency, or Special Inspector, immediately provide copies of mill reports, cutting lists, material bills, shipping bills, time and place of shipment of materials to shop, and any relevant data on previous testing and investigations of materials.
- 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.
- K. 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 or Construction Manager.
 - 2. Notify Architect and Construction Manager seven 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 and Construction Manager's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven 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, unless otherwise indicated.
 - 7. ***The Contractor's crew which builds the mockup is to be the same crew that will be installing the Work on the building.***
- L. ~~Integrated~~ Exterior Mockups: Construct ~~integrated~~ exterior mockup according to approved Shop Drawings or as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
 - 1. ***Construct two mockups as indicated on the drawings.***
 - a. ***Mockup A: full exterior mockup for testing infiltration in the following steps.***
 - 1) ***Phase 1: Test sheathing, AVB and anchors after attachment using Water Spray Test in accordance with AAMA 501.2.***
 - 2) ***Phase 2: Test completed mockup using static water penetration test in accordance with ASTM E1105***
 - 3) ***Full description of testing requirements located in Division 08 Section "Structural Sealant Glazed Curtain Walls."***
 - b. ***Mockup B: Aesthetic mockup for appearance and craftsmanship only.***
- ~~M. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups of the following rooms:~~

~~1. <Insert room name or description>.~~

~~N. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 26.~~

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency and/or Special Inspector to perform these services.
1. 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.
 2. Costs for retesting and reinspecting construction due to the following reasons will be charged to Contractor, and the Contract Sum will be adjusted by Change Order:
 - a. Additional testing required after correction of defective materials or workmanship to verify compliance with Contract Documents.
 - b. Materials or practices not complying with the Contract Documents that could possibly result in defective work rendering it necessary or advisable to perform additional testing to determine if the work is acceptable.
 - c. Changes in source, quality or characteristics of materials.
 - d. Site-cured cylinders requested by the Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform quality-control services required of Contractor by authorities having jurisdiction, 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 01 Section "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
 - 1. The Contractor shall bear all costs associated with retesting and reinspecting after the work has been corrected to further verify compliance with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine from the Architect and the Construction Manager 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 duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 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.
- G. Associated Services: 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. Cooperation and access to the Work, including (but not limited to) cooperation with testing agency personnel and Special Inspectors by providing proper facilities for access including scaffolding, temporary work platforms, and hoisting facilities required for inspections in the shop or in the field.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections, including (but not limited to) providing access to the work to be inspected or tested, obtaining and handling samples at the Site, and facilitating inspections and tests.
 - 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.
 - 8. A complete set of shop drawings for the items being tested and inspected.
- H. 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.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to Owner, Architect, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

- J. The Architect has authority to recommend that the Owner 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 whether or not such 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, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work who are in contractual relationship with the Contractor.
- K. The Contractor shall promptly correct Work rejected by the Architect 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, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, and any cost, loss or damages to the Owner resulting from such failure or defect, shall be at the Contractor's expense.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes to the satisfaction of the Architect.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 - 2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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Statement of Special Inspections

Project: *Webster University – Interdisciplinary Science Building*

Location: *Garden Avenue – Webster Groves, MO*

Owner: *Webster University*

Design Professional in Responsible Charge: *Jill Y. Walker, P.E.*

This *Statement of Special Inspections* is submitted as a condition for permit issuance in accordance with the Special Inspection and Structural Testing requirements of the Building Code. It includes a schedule of Special Inspection services applicable to this project as well as the name of the Special Inspection Coordinator and the identity of other approved agencies to be retained for conducting these inspections and tests. This *Statement of Special Inspections* encompass the following disciplines:

☒ Structural ☐ Mechanical/Electrical/Plumbing
☐ Architectural ☐ Other: _____

The Special Inspection Coordinator shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge.

A *Final Report of Special Inspections* documenting completion of all required Special Inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

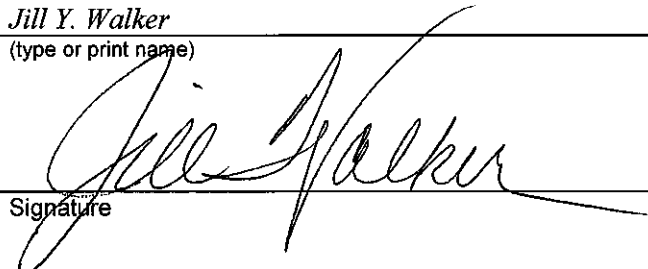
Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Interim Report Frequency: *Weekly*

or ☐ per attached schedule.

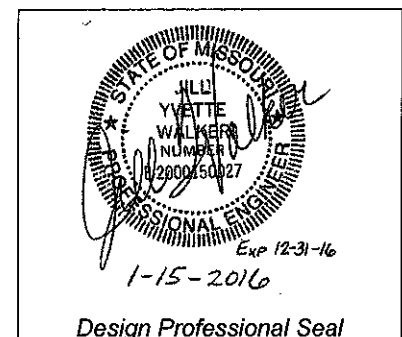
Prepared by:

Jill Y. Walker
(type or print name)


Signature

01/29/2016

Date



Owner's Authorization:

Building Official's Acceptance:

Signature

Date

Signature

Date

Schedule of Inspection and Testing Agencies

This Statement of Special Inspections / Quality Assurance Plan includes the following building systems:

- | | |
|--|--|
| ☒ Soils and Foundations | ☐ Spray Fire Resistant Material |
| ☒ Cast-in-Place Concrete | ☐ Wood Construction |
| ☐ Precast Concrete | ☐ Exterior Insulation and Finish System |
| ☐ Masonry | ☐ Mechanical & Electrical Systems |
| ☒ Structural Steel | ☐ Architectural Systems |
| ☐ Cold-Formed Steel Framing | ☐ Special Cases |

Special Inspection Agencies	Firm	Address, Telephone, e-mail
1. Special Inspection Coordinator To Be Determined	 To Be Determined	
2. Inspector To Be Determined	 To Be Determined	
3. Testing Agency To Be Determined	 To Be Determined	

Note: The inspectors and testing agencies shall be engaged by the Owner, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

Quality Assurance Plan

Quality Assurance for Seismic Resistance

Seismic Design Category *C*

Quality Assurance Plan Required (Y/N) *N*

Description of seismic force resisting system and designated seismic systems:

Steel Braced Frames not specifically detailed for seismic resistance. $R=3$

Concrete shear walls in the basement levels.

Quality Assurance for Wind Requirements

Basic Wind Speed (3 second gust) - ASD *90 MPH*

Wind Exposure Category *B*

Quality Assurance Plan Required (Y/N) *N*

Description of wind force resisting system and designated wind resisting components:

Steel Braced Frames with sub grade level concrete shear walls.

Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated above must submit a Statement of Responsibility to the Owner and Building Official prior to commencement of work on the system or component of the wind and/or seismic resisting systems. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspection.

Qualifications of Inspectors and Testing Technicians

The qualifications of all personnel performing Special Inspection and testing activities are subject to the approval of the Building Official. The credentials of all Inspectors and testing technicians shall be provided if requested.

Key for Minimum Qualifications of Inspection Agents:

When the Registered Design Professional in Responsible Charge deems it appropriate that the individual performing a stipulated test or inspection have a specific certification or license as indicated below, such designation shall appear below the *Agency Number* on the Schedule.

PE/SE	Structural Engineer – a licensed SE or PE specializing in the design of building structures
PE/GE	Geotechnical Engineer – a licensed PE specializing in soil mechanics and foundations
EIT	Engineer-In-Training – a graduate engineer who has passed the Fundamentals of Engineering examination

American Concrete Institute (ACI) Certification

ACI-CFTT	Concrete Field Testing Technician – Grade 1
ACI-CCI	Concrete Construction Inspector
ACI-LTT	Laboratory Testing Technician – Grade 1&2
ACI-STT	Strength Testing Technician

American Welding Society (AWS) Certification

AWS-CWI	Certified Welding Inspector
AWS/AISC-SSI	Certified Structural Steel Inspector

American Society of Non-Destructive Testing (ASNT) Certification

ASNT	Non-Destructive Testing Technician – Level II or III.
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International Code Council (ICC) Certification

ICC-SWSI	Structural Steel and Welding Special Inspector
ICC-SFSI	Spray-Applied Fireproofing Special Inspector
ICC-RCSI	Reinforced Concrete Special Inspector

National Institute for Certification in Engineering Technologies (NICET)

NICET-CT	Concrete Technician – Levels I, II, III & IV
NICET-ST	Soils Technician - Levels I, II, III & IV
NICET-GET	Geotechnical Engineering Technician - Levels I, II, III & IV

Exterior Design Institute (EDI) Certification

EDI-EIFS	EIFS Third Party Inspector
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Other

Soils and Foundations

Item	Agency # (Qualif.)	Scope
1. Shallow Foundations and Soils	PE/GE	<i>Inspect soils below footings for adequate bearing capacity, depth, and consistency with geotechnical report.</i> <u>Frequency:</u> Periodic <i>Inspect removal of unsuitable material and preparation of subgrade prior to placement of controlled fill</i> <u>Frequency:</u> Periodic PER IBC 2009 TABLE 1704.7
2. Controlled Structural Fill	PE/GE	<i>Perform sieve tests (ASTM D422 & D1140) and modified Proctor tests (ASTM D1557) of each source of fill material.</i> <u>Frequency:</u> Periodic <i>Inspect materials, densities, and lift thickness during placement and compaction of controlled fill.</i> <u>Frequency:</u> Continuous <i>Test density of each lift of fill by nuclear methods (ASTM D2922)</i> <u>Frequency:</u> Continuous <i>Verify extent and slope of fill placement.</i> <u>Frequency:</u> Periodic PER IBC 2009 TABLE 1704.7
3. Cast-in- Place Deep Foundations (Drilled Piers)	PE/GE	<i>Inspect and log drilled pier operations including location, diameter, bottom excavation, cut-off elevation and whether the hole was cased.</i> <u>Frequency:</u> Continuous <i>Inspect drilled pier plumbness to include horizontal and vertical alignment with installation tolerances specified. Inspect drilled pier bottom subgrade is free of debris, wet materials and water to within tolerances specified.</i> <u>Frequency:</u> Continuous <i>Verify drilled pier diameter, reinforcing cage placement including concrete cover, dowels and accessories are placed as detailed on the structural drawings.</i> <u>Frequency:</u> Continuous PER IBC 2009 TABLE 1704.8

Cast-in-Place Concrete

Item	Agency # (Qualif.)	Scope <i>SHALL BE PER IBC 2009 TABLE 1704.4</i>
1. Mix Design	ACI-CCI ICC-RCSI	Review concrete batch tickets and verify compliance with approved mix design. Verify that water added at the site does not exceed that allowed by the mix design. <u>Frequency:</u> Periodic
2. Reinforcement Installation	ACI-CCI ICC-RCSI	Inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters <u>Frequency:</u> Periodic
3. Anchor Rods	PE/SE	Inspect size, positioning, projection above finish surface and embedment of anchor rods. Inspect concrete placement and consolidation around anchors. <u>Frequency:</u> Continuous
4. Post-Installed Anchors	PE/SE	Inspect product, size, positioning, finish, and embedment of anchors. Inspect installation procedure as defined by the anchor manufacturer. <u>Frequency:</u> Periodic
5. Concrete Placement	ACI-CCI ICC-RCSI	Inspect placement of concrete. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated. <u>Frequency:</u> Continuous
6. Sampling and Testing of Concrete	ACI-CFTT ACI-STT	Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064). <u>Frequency:</u> Continuous
7. Curing and Protection	ACI-CCI ICC-RCSI	Inspect curing, cold weather protection and hot weather protection procedures. <u>Frequency:</u> Periodic
8. Waterstops	PE/SE	Inspect position and embedment of waterstops and lap at splice locations. Verify that waterstop is free of dirt, construction debris, form oil, etc., and does not interfere with reinforcing bars before next concrete pour. <u>Frequency:</u> Continuous

Structural Steel

Item	Agency # (Qualif.)	Scope <i>SHALL BE PER IBC 2009 TABLE 1704.3</i>
	AWS/AISC- SSI ICC-SWSI	<i>Review shop fabrication and quality control procedures. <u>Frequency:</u> Periodic.</i>
2. Material Certification	AWS/AISC- SSI ICC-SWSI	<i>Review certified mill test reports and identification markings on structural steel, metal deck, high-strength bolts, nuts and welding materials. <u>Frequency:</u> Periodic.</i>
4. Bolting	AWS/AISC- SSI ICC-SWSI	<i>Inspect installation and tightening of high-strength bolts. Verify that splines have separated from tension control bolts. Verify proper tightening sequence. <u>Frequency:</u> Periodic, Unless Noted Otherwise Continuous, bolts in slip-critical connections</i>
5. Welding	AWS-CWI ASNT	<i>Visually inspect all welds. Inspect pre-heat, post-heat and surface preparation between passes. Verify size and length of fillet welds. <u>Frequency:</u> Continuous, Unless Noted Otherwise Periodic, Single Pass Fillets equal to or less than 5/6" Floor and Roof deck welds</i>
6. Structural Details	PE/SE	<i>Inspect steel framing members for compliance with structural drawings, including shape, member configuration and connection details. <u>Frequency:</u> Periodic</i>
8. Embedded Plates	PE/SE	<i>Inspect embedded plate size and stud layout for compliance with structural drawings, including stud size and length. <u>Frequency:</u> Periodic</i>

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SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- J. "Contract Limit": Space available for performing construction activities; the primary area of Work may be indicated by a Limit of Construction line on Drawings, but Work necessary to complete the Project can also occur beyond this limit. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- K. "Remove": Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- L. "Remove and Salvage": Detach items from existing construction and deliver them to Owner[**ready for reuse**].
- M. "Salvage": Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner[**ready for reuse**]. Include fasteners or brackets needed for reattachment elsewhere.
- N. "Remove and Reinstall": Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- O. "Existing to Remain": Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- P. "Demolish": Tearing down, destruction, breakup, razing or removal of the whole or part of a building or structure, or a free standing machinery or equipment that is directly related to the function of the structure.
- Q. "Recycle": Recovery of demolition waste for subsequent processing in preparation for reuse.

- R. Permanent Enclosure: As determined by Architect, the condition at which roofing is insulated and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures equivalent in weather protection to permanent construction.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. AABC - Associated Air Balance Council; www.aabc.com.
 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 7. ABMA - American Boiler Manufacturers Association; www.abma.com.
 8. ACI - American Concrete Institute; (Formerly: ACI International); www.abma.com.
 9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 11. AF&PA - American Forest & Paper Association; www.afandpa.org.
 12. AGA - American Gas Association; www.aga.org.
 13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 15. AI - Asphalt Institute; www.asphaltinstitute.org.
 16. AIA - American Institute of Architects (The); www.aia.org.
 17. AISC - American Institute of Steel Construction; www.aisc.org.
 18. AISI - American Iron and Steel Institute; www.steel.org.
 19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 21. ANSI - American National Standards Institute; www.ansi.org.
 22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 23. APA - APA - The Engineered Wood Association; www.apawood.org.
 24. APA - Architectural Precast Association; www.archprecast.org.
 25. API - American Petroleum Institute; www.api.org.
 26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
 27. ARI - American Refrigeration Institute; (See AHRI).
 28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.

29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWWA - American Water Works Association; www.awwa.org.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; (See ECIA).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; www.eciaonline.org.
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.

77. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
83. FM Approvals - FM Approvals LLC; www.fmglobal.com.
84. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
86. FSA - Fluid Sealing Association; www.fluidsealing.com.
87. FSC - Forest Stewardship Council U.S.; www.fscus.org.
88. GA - Gypsum Association; www.gypsum.org.
89. GANA - Glass Association of North America; www.glasswebsite.com.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
93. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
94. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
95. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
96. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
97. IAS - International Accreditation Service; www.iasonline.org.
98. IAS - International Approval Services; (See CSA).
99. ICBO - International Conference of Building Officials; (See ICC).
100. ICC - International Code Council; www.iccsafe.org.
101. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
102. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
103. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
104. IEC - International Electrotechnical Commission; <http://www.iec.ch>.
105. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
106. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
107. IESNA - Illuminating Engineering Society of North America; (See IES).
108. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
109. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
110. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
111. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
112. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
113. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
114. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
115. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
116. ISO - International Organization for Standardization; www.iso.org.
117. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
118. ITU - International Telecommunication Union; www.itu.int/home.
119. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
120. LMA - Laminating Materials Association; (See CPA).
121. LPI - Lightning Protection Institute; www.lightning.org.
122. MBMA - Metal Building Manufacturers Association; www.mbma.com.
123. MCA - Metal Construction Association; www.metalconstruction.org.
124. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.

125. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
126. MHIA - Material Handling Industry of America; www.mhia.org.
127. MIA - Marble Institute of America; www.marble-institute.com.
128. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
129. MPI - Master Painters Institute; www.paintinfo.com.
130. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
131. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
132. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
133. NADCA - National Air Duct Cleaners Association; www.nadca.com.
134. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
135. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
136. NBI - New Buildings Institute; www.newbuildings.org.
137. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
138. NCMA - National Concrete Masonry Association; www.ncma.org.
139. NEBB - National Environmental Balancing Bureau; www.nebb.org.
140. NECA - National Electrical Contractors Association; www.necanet.org.
141. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
142. NEMA - National Electrical Manufacturers Association; www.nema.org.
143. NETA - InterNational Electrical Testing Association; www.netaworld.org.
144. NFHS - National Federation of State High School Associations; www.nfhs.org.
145. NFPA - National Fire Protection Association; www.nfpa.org.
146. NFPA - NFPA International; (See NFPA).
147. NFRC - National Fenestration Rating Council; www.nfrc.org.
148. NHLA - National Hardwood Lumber Association; www.nhla.com.
149. NLGA - National Lumber Grades Authority; www.nlga.org.
150. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
151. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
152. NRCA - National Roofing Contractors Association; www.nrca.net.
153. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
154. NSF - NSF International; www.nsf.org.
155. NSPE - National Society of Professional Engineers; www.nspe.org.
156. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
157. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
158. NWFA - National Wood Flooring Association; www.nwfa.org.
159. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
160. PDI - Plumbing & Drainage Institute; www.pdionline.org.
161. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
162. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
163. RFCI - Resilient Floor Covering Institute; www.rfci.com.
164. RIS - Redwood Inspection Service; www.redwoodinspection.com.
165. SAE - SAE International; www.sae.org.
166. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
167. SDI - Steel Deck Institute; www.sdi.org.
168. SDI - Steel Door Institute; www.steeldoor.org.
169. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
170. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
171. SIA - Security Industry Association; www.siaonline.org.
172. SJI - Steel Joist Institute; www.steeljoist.org.
173. SMA - Screen Manufacturers Association; www.smainfo.org.
174. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.

175. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
 176. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
 177. SPIB - Southern Pine Inspection Bureau; www.spib.org.
 178. SPRI - Single Ply Roofing Industry; www.spri.org.
 179. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
 180. SSINA - Specialty Steel Industry of North America; www.ssina.com.
 181. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
 182. STI - Steel Tank Institute; www.steeltank.com.
 183. SWI - Steel Window Institute; www.steelwindows.com.
 184. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
 185. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
 186. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
 187. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
 188. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
 189. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
 190. TMS - The Masonry Society; www.masonrysociety.org.
 191. TPI - Truss Plate Institute; www.tpinst.org.
 192. TPI - Turfgrass Producers International; www.turfgrasssod.org.
 193. TRI - Tile Roofing Institute; www.tilerroofing.org.
 194. UL - Underwriters Laboratories Inc.; www.ul.com.
 195. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 196. USAV - USA Volleyball; www.usavolleyball.org.
 197. USGBC - U.S. Green Building Council; www.usgbc.org.
 198. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 199. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 200. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 201. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 202. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 203. WI - Woodwork Institute; www.wicnet.org.
 204. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 205. WWPA - Western Wood Products Association; www.wwpa.org.
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.

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7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.

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7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development;
www.txforestservation.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow all other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- C. 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.
- D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.
 - 5. Other dust-control measures.

1.4 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.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 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 galvanized steel bases for supporting posts.
- B. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- F. Paint: Comply with requirements in Division 09 painting Sections.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack board.
 - 3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 4. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.
- D. Ramps and Stairs: Provide temporary ramps and stairs where indicated on drawings and otherwise as needed to maintain egress pathways throughout construction. Construction of ramps and stairs shall comply with all codes and standards listed on the Code Compliance drawings including ADAAG.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; 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. 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 and clean HVAC system as required in Section 017700 "Closeout Procedures".
 - 3. Provide the following temporary filtration and pressure systems:
 - a. Maintain work site under negative pressure at all times. Test pressure differential at beginning of construction each day with manometer, vanometer, or other such device. Do not proceed with work until negative pressure relationship has been.
 - b. Exhaust air directly to the exterior or into an existing return air system through portable HEPA filters.
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

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. Obtain Owner approval for location and relocation of facilities.
- 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.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

- D. 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.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations and existing conditions 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.
- F. 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 according to 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.
- G. 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.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- H. 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.
- I. 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.
 - 2. Install lighting for Project identification sign.
 - 3. Provide the following minimum lighting levels:
 - a. Corridor and Stairhalls: 1 foot candle.
 - b. Unoccupied Work Spaces: 1 foot candle.
 - c. Occupied Work Spaces and Storage Spaces: 5 to 10 foot candles.
 - d. Work Areas: 30 foot candles.
- J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide incombustible construction for 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. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated within construction limits indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earth Moving."
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 32 Section "Asphalt Paving."
- D. 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.
- E. Parking: Use designated areas of Owner's existing parking for construction personnel.
- F. 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.
- G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- H. 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.
- I. Temporary Elevator Use: Use of elevators is not permitted.
- J. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

- K. Existing Structures: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement or collapse of construction and finishes to remain.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. 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.
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 31 Sections.
- D. 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.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.
- G. 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: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.
- H. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- K. Covered Walkway: Erect structurally adequate, protective, covered walkway for passage of individuals along adjacent public street(s). Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
 - 1. Construct covered walkways using scaffold or shoring framing.
 - 2. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.

3. Extend back wall beyond the structure to complete enclosure fence.
 4. Paint and maintain in a manner approved by Owner and Architect.
- L. Temporary Enclosures: Provide temporary enclosures for protection of **[existing] [and new]** construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
 2. Construct dustproof partitions with 2 layers of 3-mil (0.07-mm) polyethylene sheet on each side. Cover floor with 2 layers of 3-mil (0.07-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
 3. Insulate partitions to provide noise protection to occupied areas.
 4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 5. Protect air-handling equipment.
 6. Weather strip openings.
 7. Provide walk-off mats at each entrance through temporary partition.
- N. Temporary Fire Protection: Install 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 all areas of the Site.
 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.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

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 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 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. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. 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.

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2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

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SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

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 general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Sections:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
 - 2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, as indicated on Drawings.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by ISA.
- B. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
 - b. Enforcing requirements for protection zones.
 - c. Arborist's responsibilities.
 - d. Field quality control.

1.5 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than **1 inch** in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
 - 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- B. Topsoil: **Imported or manufactured topsoil complying with ASTM D 5268.**
- C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements. Previously used materials may be used when approved by Landscape Architect.
 - 1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch-diameter wire chain-link fabric; with 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 rails and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - a. Height: 6 feet.
 - 2. Gates: Single or Double swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width as required by Webster University.
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 - 1. Size and Text: As shown on Drawings.

2. Lettering: as indicated on drawings. black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE- AND PLANT-PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Landscape Architect.
 3. Access Gates: Install as directed by Webster University; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Landscape Architect. Install one sign spaced approximately every 50 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.

- E. Maintain protection-zone fencing and signage in good condition as acceptable to Landscape Architect and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots,, as follows:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Cut Ends: Do not paint cut root ends.
 - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 4. Cover exposed roots with burlap and water regularly.
 - 5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune roots flush with the edge of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation 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.

3.6 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.7 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.
 - 1. Submit details of proposed root cutting and tree and shrub repairs.
 - 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - 3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 - 4. Perform repairs within 24 hours.
 - 5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect or City of Webster Groves determines are incapable of restoring to normal growth pattern.
 - 1. Provide new trees as required by the City of Webster Groves
- C. Soil Aeration: Where directed by Landscape Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products containing material with recycled-content are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

- A. Product List: Submit an Excel list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
 - 1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 - 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.

3. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 4. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
 5. Final Accepted List: Final list shall be updated throughout the Project, as necessary due to uncontrollable changes, and submitted as part of Project Record Documents at Final Completion.
- B. Substitution Requests: Within 35 days after receipt of Bids, low bidders will be asked to submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use Form provided in this Project Manual.
 2. Substitution requests will only be reviewed and considered when submitted by a bidding Contractor. Architect will not respond to requests received by any other party.
 3. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. 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 lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. 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.

4. 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 through Construction Manager 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. Architect's notification will be in one the following forms:
 - a. Form of Acceptance:
 - 1) Prior to signing of Contract: Form provided in this Project Manual.
 - 2) After Contract signing: Change Order.
 - b. Use product specified if information is not submitted in sufficient time for Architect to make a decision or is rejected.
- C. Comparable Product Requests: If a product or system other than the "Basis of Design" product or system is intended to be used, submit the comparable product or system for evaluation within the first 30 days of the award of the construction contract in compliance with the following:
 1. Contractor Action: Submit 3 copies of the completed form used for substitution requests as identified in Division 01 Section "Product Requirements."
 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one (1) week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified when Architect does not approve the use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.4 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. Asbestos Content: All products furnished and/or installed for this Project must be 100 percent free of asbestos containing materials.
- C. Electrical Products and Materials: All electrical products and materials furnished and/or installed for this Project must bear the Underwriter's Laboratories (U.L.), or other accepted agencies listing label. Any Project-related modification to these products must be in compliance with the National Electrical Code requirements and listed by U.L.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
 1. Coordinate deliveries to the site with the Owner, Architect, Construction Manager so as to allow for inspection by these parties prior to incorporation in the Work.

2. Any materials which the Owner, Architect, Construction Manager determines cannot be received on site will be stored off-site in a secure location, at no additional cost to the Contract, until they can be received at the site. Contractor/Subcontractor must insure off-site storage against damage or loss and provide record of material insurance to the Owner, Construction Manager.
3. Be prepared to provide signed material receipts to the Owner, Construction Manager upon request.

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.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Construction Manager is responsible for designating and allotting on-site storage space. Any relocation of stored materials necessitated by Work progress will be accomplished promptly without additional cost to the Contract.
2. Except as otherwise specified, each Contractor/Subcontractor is responsible for its tools, equipment, materials, and supplies on the Site whether just stored or incorporated into the Work until building is accepted by the Owner.
3. Store products to allow for inspection and measurement of quantity or counting of units.
4. Store materials in a manner that will not endanger Project structure.
5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
6. Store cementitious products and materials on elevated platforms.
7. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage and liquids from freezing.
10. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

- A.** Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Owner.

- B.** **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. The Contract Documents are intended to produce a building of consistent character and quality of design. All components of the building including visible items of Division 21 through 28 engineering equipment have been selected to have a coordinated design in relation to the overall appearance of the building. The Architect shall judge the design and appearance of proposed substitutes on the basis of their suitability in relation to the overall design of the Project, as well as for their intrinsic merits. The Architect will not approve as equal to materials specified proposed substitutes which, in the Architect's opinion, would be out of character, obtrusive, or otherwise inconsistent with the character or quality of design of the Project. In order to permit coordinated design of color and finishes the Contractor shall, if required by the Architect, furnish the substituted material in any color, finish, texture, or pattern which would have been available from the manufacturer originally specified, at no additional cost to the Owner.
- B. Any additional cost, or any loss or damage arising from the substitution of any material or any method for those originally specified shall be borne by the Contractor, notwithstanding approval or acceptance of such substitution by the Owner or the Architect, unless such substitution was made at the written request or direction of the Owner or the Architect.
- C. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a 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.
- D. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions will be considered only in accordance with provisions in General Conditions

- b. Non-Restricted List: 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. Comply with requirements in "Product Substitutions" and "Comparable Products" Articles for consideration of an unnamed product.
 - 4. Manufacturers:
 - a. 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 will be considered only in accordance with provisions in General Conditions
 - b. Non-Restricted List: 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. Comply with requirements in "Product Substitutions" and "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 - 5. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in General Conditions and Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
 - 6. 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 provisions in General Conditions and Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
 - E. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with provisions in General Conditions and Part 2 "Product Substitutions" Article for proposal of product.
 - F. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with requirements.
 - 1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - 2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- 2.2 PRODUCT SUBSTITUTIONS SUBSEQUENT TO DEFINED PERIOD TO RECEIVE REQUESTS
- A. Timing: Architect will consider requests for substitution only in accordance with provision in the General Conditions of the Contract for Construction and as indicated above.
 - B. Conditions: Architect will consider Contractor's request for substitution when the requirements specified in the General Conditions of the Contract for Construction and the following conditions are met. If all conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requests for substitution must include clear identification of the material, product or equipment item and complete description including drawings, cuts, performance and test data, along with any other information necessary for a complete evaluation.
2. Substitution request is fully documented and properly submitted.
3. Requested substitution will not adversely affect Contractor's Construction Schedule.
4. Requested substitution has received necessary approvals of authorities having jurisdiction.
5. Requested substitution is compatible with other portions of the Work.
6. Requested substitution provides specified warranty.
7. Requested substitution will not delay the Work.
8. 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.
9. The Architect's/Owner's decision to accept or reject the proposed substitution shall be final and will be set forth in writing.

2.3 COMPARABLE PRODUCTS

- A. "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 Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
 1. When less than three (3) manufacturer's materials, products or equipment items are specified and the phrase "Or Equal" OR "Equivalent To" is stated, requests for comparable products are permitted and will be considered when submitted as indicated above.
- B. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 1. Certification that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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**Interdisciplinary Science Building
Webster University
Cannon Design Project No. 004561.01**

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____
Re: _____ Contract For: _____

Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Trade Name: _____
Model No.: _____
Manufacturer: _____
Address: _____

Phone: _____ Manufacturer Web Page: _____

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

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

Savings to Owner for
accepting substitution: _____ (\$ _____)

Proposed substitution
changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

The Undersigned Bidding General Contractor/Construction Manager Certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified products.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

**Interdisciplinary Science Building
Webster University
Cannon Design Project No. 004561.01**

- The following supporting data is attached to this request and verifies the above statements:

- ☐ Drawings
- ☐ Product Data
- ☐ Samples
- ☐ Tests
- ☐ Reports
- ☐ Other (explain) _____

Submitted by: _____

Signed by: _____

Contractor: _____

Address: _____

Phone: _____ Email : _____

Review and Action

- ☐ Substitution approved – Make submittals in accordance with the Specifications.
- ☐ Substitution approved as noted – Make submittals in accordance with the Specifications.
- ☐ Substitution rejected – Use specified materials.
- ☐ Substitution received too late – Use specified materials.

Comments: _____

Signed by: _____ Date: _____

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Coordination of Owner-installed products.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
 - 8. Correction of the Work.

1.2 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two copies signed by land surveyor.
- D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.3 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. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. 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. Verify field dimensions.
 5. Test surfaces where the surface dryness is in question with a current moisture-indicating device.
- D. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- E. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions and the responsibility for any corrective work required due to faulty base surfaces or improper 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 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 Division 01 Section "Project Management and Coordination." Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

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 and Construction Manager promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish limits on use of Project site.
 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect[and Construction Manager] before proceeding.
 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
 5. Install materials, products and equipment such that manufacturer's labels do not appear on exposed surfaces of the finished work, except in unfinished portions of the building such as mechanical equipment rooms.
 6. Install materials, products and equipment so they are readily accessible for operation, maintenance and repair. Minor deviations from Drawings may be made to accomplish required accessibility, but changes involving extra cost shall not be made without prior written approval.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. 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.
- 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 OWNER-INSTALLED PRODUCTS

- A. Owner-Furnished Owner-Installed Products:
 - 1. Products indicated as "O.F.O.I." (Owner Furnished, Owner Installed) will be furnished and installed by the Owner. Mechanical and electrical service lines and support systems for such products, where indicated, shall be included in the Contract Sum. Final connections from service lines to the equipment will be provided by the Owner, unless otherwise indicated.
 - 2. Refer to Division 01 Section "Summary" for requirements and procedures for "Owner-Furnished Products."
- B. Site Access: Provide access to Project site for Owner's construction forces.
- C. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
 - 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 forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 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 waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
 - 3. Place waste materials in containers provided for this purpose.
 - 4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 - 5. Provide sufficient quantity of waste containers on Site and on each floor of building and in each work area for collection of waste materials, rubbish and debris.
 - a. Refer to Division 01 Section "Construction Waste Management" for additional requirements for waste containers for recycling of waste materials.
 - 6. Lower waste materials from building in a controlled manner; do not drop or throw materials from heights.
 - 7. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- 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 in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal:
1. Each Contractor shall remove his own waste and surplus materials without interference with others at least once per week or more often if waste and surplus materials interfere with the work of others or present a fire or safety hazard.
 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 (27 deg C).
 3. Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
 4. Refer to Division 01 Section "Construction Waste Management" for additional requirements for waste disposal and recycling.
- H. 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.
- I. 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.
- J. 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.
- K. Cost of Progress Cleaning:
1. Cost of providing containers, placing waste materials in containers and disposing of waste in containers is the responsibility of the Contractor.
 2. Cost of providing containers and disposing of waste in containers is the responsibility of:
 - a.
 - b.
 - c. General Construction Contractor.
 3. Cost of placing waste materials in containers is the responsibility of Contractor creating the waste materials.

3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. 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 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Contractor is responsible for protection and safekeeping of his materials, products, and equipment stored on the premises or incorporated into the construction until his contract is complete and accepted by the Owner.
- B. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

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SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Each Contractor is responsible for all cutting, fitting and patching required for alteration Work or to correct or modify newly installed construction, including but not limited to:
 - 1. Coordination between all trades.
 - 2. Performing sequential excavation and backfill.
 - 3. Completing the Work or making its several parts fit together properly or integrate with other Work.
 - 4. Uncovering portions of the Work to provide for installation of ill-timed Work.
 - 5. Removing and replacing defective Work.
 - 6. Removing and replacing Work not conforming to requirements of Contract Documents.
 - 7. Removing samples of installed Work as specified for testing.
 - 8. Providing routine penetrations of non-structural surfaces for installation of materials such as piping and electrical conduit.

1.2 DEFINITIONS

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

1.3 SUBMITTALS

- A. Cutting and Patching Plan: Submit a plan describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 - a. For cutting and patching of newly installed construction, employ the original installer or fabricator for weather-exposed or moisture-resistant elements, and sight exposed finished surfaces.
 - b. Include workmen qualifications for cutting and patching of weather-exposed or moisture-resistant elements, and sight exposed finished surfaces of existing construction being altered.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

- a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Enclosure Elements: Indicate measures regarding the integrity or effectiveness of weather-exposed or moisture-resistant elements and systems.
8. Alternatives to Cutting and Patching: Include a description of alternatives to cutting and patching.
9. Notices: Notify Owner and separate contractor when cutting and patching affects newly installed construction not performed under this Project; include evidence of notification and written permission.
10. Architect's and Construction Manager's Approval: Obtain approval of cutting and patching plan before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 1. A structural element includes any load-bearing, lateral force-resistant member, and wind or seismic movement resisting construction.
 2. Take precautions and exercise care to ensure Work is removed neatly and without movement or settlement to remainder of building. Contractor will be held liable for any damage, movement, settlement caused thereby or resulting therefrom.
- B. 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. Examples of operating elements include, but are not limited to, the following:
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-suppression systems.
 4. Mechanical systems piping and ducts.
 5. Control systems.
 6. Communication systems.
 7. Conveying systems.
 8. Electrical wiring systems.
 9. Operating systems of special construction in Division 13 Sections.
- C. 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. Examples of miscellaneous elements include, but are not limited to, the following:
 1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.

- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- F. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.
- G. Qualifications: Workmen to have minimum three (3) years experience in working with materials being cut and patched.

1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials.
 - 1. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 2. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.
- C. Materials used for sealing openings shall have a fire rating equal to or greater than the rating of the floor, ceiling or partition and shall comply with applicable codes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. 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.
- C. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

- A. 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.
 - 2. Restore Work and surfaces with new products in accordance with requirements of the Contract Documents.
- B. 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. Employ original Installer for cutting and patching of newly installed construction; 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 as small as possible, neatly to 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 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.
- C. 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 possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate 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 eliminate evidence of patching and refinishing.
 - a. Refinish entire surfaces as necessary to provide an even new finish.
 - b. For continuous surfaces, refinish to nearest intersection.
 - c. For assemblies, entirely refinish.
 - d. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - e. 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. Patch subfloors under removed partitions, fixed equipment, etc. by cutting back, applying underlayment, concrete fill or other acceptable leveling fill as necessary to provide subfloor that is level with adjacent existing subfloors and properly prepare to receive finish flooring.
 - b. In renovated rooms/areas to receive new floor finishes, remove existing finish flooring and related materials and prepare subfloor by cutting back, applying concrete fill or other acceptable leveling fill as necessary to provide subfloor that is level and properly prepared to receive new floor finish as required by Room Finish Schedule and material manufacturers written recommendations.
 - c. In renovated rooms/areas to receive new wall finishes, those portions of existing walls that remain shall have their surfaces patched, cut back, or brought forward as necessary, and prepared as required to receive the new finishes per Room Finish Schedule.
 - d. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for the 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.
 - e. In rooms or areas where patching is required on one wall only, that entire wall is to be refinished to match the existing finish and color, including existing painted doors, door frames and window frames if they occur in that wall.
 - f. In rooms or areas where patching is required on two or more walls, all walls, including painted doors, door frames and painted window frames, are to be refinished.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - a. In rooms or areas where patching is required in an existing plaster or gypsum wallboard ceiling, the entire ceiling is to be repainted. In rooms where patching is required in existing acoustic tile ceilings, patch ceilings with matching type and pattern of acoustic tile, clean all remaining tile and apply one coat of white latex paint by roller over all tile surfaces. Clean all exposed metal suspension system.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
 6. Openings created as a result of removal of materials must be patched to match adjacent construction as to materials and finishes, unless otherwise indicated.
 - a. Contractor responsible for cutting and patching shall also be responsible for furnishing and installing lintels where openings are cut through existing masonry or concrete walls. Refer to Lintel Schedule in Division 05 Section "Metal Fabrications" for sizing of lintels, unless lintels are shown on Drawings.
 7. Where existing equipment is removed and new equipment is installed in the existing opening, the Contractor installing the new equipment shall close up the unused portion of the opening with materials matching adjacent construction.
 8. When new rubber or vinyl stair treads, risers and landings, are installed at existing stairs, paint all exposed steel.
 9. Paint all exposed insulated or non-insulated pipes and ducts in finished rooms or areas.
 10. Where existing equipment or assemblies are removed, the Contractor removing the equipment shall patch and repair the floor, walls and ceiling.
- D. Roofing:
1. Before commencing with cutting and patching of roofing, consult with the Owner regarding the existence of an outstanding roofing warranty. If such a warranty exists, obtain written approval of the methods to be used from the roofing manufacturer who issued the warranty so as not to affect the value of the warranty.

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2. If necessary, cutting and patching of roofing to be performed by roofing manufacturer authorized personnel only.
3. Cut, patch, repair and extend roofing and insulation as follows:
 - a. Where disturbed or damaged by alteration Work or activities related to same.
 - b. Where new Work connects to existing construction.
4. Roof areas penetrated for alterations shall be protected against damage and leakage by the Contractor performing the Work. Roof openings shall not be left uncovered or unprotected overnight or during any periods of rainy or inclement weather.
5. Remove loose aggregate, if applicable, and store away from work area.
6. Work shall be performed in a manner to provide for permanent water-tight splice or repair.
7. Roof repair and alteration Work and materials shall match existing roofing materials and construction.
8. Upon completion and inspection of splice or repair Work, remove debris from the roof and replace the aggregate as required.
9. Protect undisturbed existing and newly repaired roofing subject to traffic and damage.

3.4 CLEANING

- A. Clean areas and spaces where cutting and patching are performed.
- B. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous construction waste.
 - 2. Recycling nonhazardous construction waste.
 - 3. Disposing of nonhazardous construction waste.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:
 - 1. Construction Waste:
 - a. Masonry and CMU.
 - b. Lumber.
 - c. Wood sheet materials.
 - d. Wood trim.
 - e. Metals.
 - f. Roofing.
 - g. Insulation.
 - h. Carpet and pad.
 - i. Gypsum board.
 - j. Piping.
 - k. Electrical conduit.
 - l. Packaging: Regardless of salvage/recycle goal indicated 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.

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- D. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- E. LEED Submittal: LEED letter template for Credit MR 2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- F. Qualification Data: For Waste Management Coordinator.

1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, accredited by the USGBC, as waste management coordinator. Waste management coordinator may also serve as LEED coordinator.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.

3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste. Include the following:
 1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in hauling and tipping fees by donating materials.
 7. Savings in hauling and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement 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.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 4. Store components off the ground and protect from the weather.
 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Division 32 Section "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Division 32 Section "Plants" for use of clean ground gypsum board as inorganic soil amendment.

3.4 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.
- C. Disposal:** Transport waste materials off Owner's property and legally dispose of them.

Attachments:

Form CWM-1 for construction waste identification.
Form CWM-3 for construction waste reduction work plan.
Form CWM-5 cost/revenue analysis of construction waste reduction work plan.
Form CWM-7 for construction waste

END OF SECTION 017419

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FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION

**Interdisciplinary Science Building
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MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A x B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							

Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							
* Insert units of measure.							

FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN

**Interdisciplinary Science Building
Webster University
Cannon Design Project No. 004561.01**

MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						

Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

**FORM CWM-5: COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE
REDUCTION WORK PLAN**

**Interdisciplinary Science Building
Webster University
Cannon Design Project No. 004561.01**

MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut- Offs								
Lumber: Warped Pieces								
Plywood or								

OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT

**Interdisciplinary Science Building
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MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								

Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut- offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

1.2 DEFINITIONS

- A. 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 and when only minor items can be corrected or completed without any material interference with the Owner's use of the work remain to be corrected or completed.

1.3 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items (Punch List): Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. When the Contractor considers that the Work, or a portion thereof designated in the Contract Documents for separate completion, is substantially complete the Contractor shall prepare and submit to the Architect:
 - 1. List of items to be completed or corrected prior to final payment;
 - 2. All special warranties required by the Contract Documents, endorsed by the Contractor and in a form reasonably acceptable to the Architect
 - 3. Any occupancy permit and any certificates of final inspection of any part of the Contractor's work
 - 4. Operating permits for any mechanical apparatus, such as elevators, escalators, boilers, air compressors, etc., which may be required by law to permit full use and occupancy of the premises by the Owner. Receipt of such permits or certificates by the Architect shall be a condition precedent to Substantial Completion of the Work.

The failure to include any items on the list mentioned in the preceding sentence does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

- B. 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.
- C. Upon receipt of the Contractor's list, if acceptable to the Architect, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect, based upon reasonable knowledge of the Work, does not agree with the Contractor that the Work is substantially complete; the Architect will return the list to the Contractor with recommendations. The Architect will make an inspection only if to the best of his knowledge and belief the Work 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.
- D. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete in request.
 - 1. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 2. 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.
 - 3. 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.
 - 4. Deliver certificates of inspection confirming compliance with applicable codes and regulations for the following:
 - a. Elevators.
 - b. Plumbing and drainage.
 - c. Heating, ventilating and air conditioning.
 - d. Fire protection.
 - e. Electrical.
 - 5. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items to location designated by Construction Manager. 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 Construction Manager's signature for receipt of submittals.
 - 6. Submit test/adjust/balance records.
 - 7. Submit changeover information related to Owner's occupancy, use, security, operation, and maintenance.

- E. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 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 Division 01 Section "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.
- F. Inspection: Submit a written request for inspection for Substantial Completion 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 and Construction Manager will Schedule 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

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining date of Final Completion, complete all items listed in the General Conditions of the Contract for Construction and the following:
1. Submit a final Application for Payment according to Division 01 Section "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. The 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 and requirements specified in the General Conditions of the Contract for Construction.
 4. Pest-Control: Submit pest-control final inspection report and warranty.
 5. Project Record Documents: Submit documentation specified below for "Project Record Documents."
- B. Procedures Prior to Final Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Final Completion. List items below that are incomplete at time of request.
1. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videos.

2. Project Record Documents: Prepare Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
- C. 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 and Construction Manager 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. Contractor shall take immediate action to complete all remaining work deemed necessary by Architect.
 2. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 3. Should Architect be required to perform second inspection because of failure of Work to comply with original notification of Contractor, the Owner will compensate Architect for additional services, and deduct amount paid from final payment to Contractor.

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 and Construction Manager.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect, through Construction Manager, 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.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

- 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Replace parts subject to unusual operating conditions.
 - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - q. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - s. Leave Project clean and ready for occupancy.
 - C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare a written report.
 - D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.
 - E. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."
- 3.2 REPAIR OF THE WORK
- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
 - B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

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4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Manual Content Submittal: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Manual Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory, including bookmarks for each portion.
 - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. 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 revise 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.

1.4 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. 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.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- 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."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: 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. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 9. 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.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- 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. 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: Enable bookmarking of 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.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

- A. 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.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
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.

C. 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.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish.

Section format to follow that of the Project Manual(s). Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product 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.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. 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.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. 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 warranty and bond information, as described below.
- B. 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.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed maintenance instructions and bulletins.
 - 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.
- D. 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.
- E. 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.
- F. 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.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. 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.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 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.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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.
 - 1. 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.
- F. 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. Do not use original Project Record Documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."
- G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one of file prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- E. Certification: With each application for payment, provide written certification that Project Record Documents are current at time application is submitted.
- F. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

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1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. 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 first floor.
 - d. Locations and depths of underground utilities referenced to permanent surface improvements.
 - 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 referenced to visible and accessible features of the structure.
 - j. Changes made by addendum.
 - k. Changes made by Change Order or Construction Change Directive.
 - l. Changes made following Architect's and Construction Manager's written orders.
 - m. Details not on the original Contract Drawings.
 - n. Field records for variable and concealed conditions.
 - o. 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. Use personnel proficient at recording graphic information in production of marked-up record prints.
 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 File: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect and Construction Manager. When authorized, prepare a full set of digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
 4. Refer instances of uncertainty to Architect through Construction Manager for resolution.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect and Construction Manager for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect and Construction Manager.
 - e. Name of Contractor.

2.2 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.
- B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 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 Specifications, and Record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.
1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 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 scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples 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 and Construction Manager's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator instructor .
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect and Construction Manager.
 - d. Name of Contractor.
 - e. Date of video recording.
 - 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 - 3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

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- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to 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.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for operation, adjustment and maintenance of each system and equipment 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. Use the operating and maintenance manuals required by the Contract Documents as the basis for instruction, including a full detailed review of them manual's contents including explanation of all aspects of operation and maintenance. Prepare and include additional data when the need for additional data becomes apparent during the training sessions. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 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.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual organized in coordination with requirements in Division 01 Section "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times after all final inspections, tests, and repairs have been completed. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.
 - 2. Schedule training during Contractor's normal week and daily hours. The Owner shall have the responsibility of scheduling Owner's shift work personnel accordingly.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
 - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
 - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.

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4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

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**SECTION 018113.13 - SUSTAINABLE DESIGN REQUIREMENTS - LEED 2009 FOR NEW
CONSTRUCTION AND MAJOR RENOVATIONS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain USGBC LEED prerequisites and credits needed for Project to obtain LEED Silver certification based on USGBC's "LEED 2009 for New Construction & Major Renovations."
 - 1. Other LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 - 2. A copy of the LEED Project checklist is attached at the end of this Section for information only.
 - a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
 - 3. Specific requirements for LEED are included in greater detail in other Sections.

1.2 DEFINITIONS

- A. LEED: USGBC's "LEED 2009 for New Construction & Major Renovations."
 - 1. Definitions that are a part of "LEED 2009 for New Construction and Major Renovations" apply to this Section.
- B. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- C. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- D. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. Review LEED requirements and action plans for complying with requirements.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the project's LEED certification application. Document responses as informational submittals.
- B. Submit documentation to USGBC and respond to questions and requests from USGBC about LEED prerequisites and credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until USGBC has made its determination on Project's LEED certification application.
 - 1. Document correspondence with USGBC as informational submittals.

1.5 ACTION SUBMITTALS

- A. General: Submit additional sustainable design submittals required by other Specification Sections.
- B. Sustainable design submittals are in addition to other submittals.
 - 1. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated LEED requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."
 - 2. LEED submittals must be differentiated from items submitted to comply with other requirements, such as Product Data and Certificates. For each product identified within the LEED Action Plan or indicated for LEED submittal within the Project Manual, verify compliance with indicated LEED requirements and required documentation; attach evidence of compliance from either the manufacturer or an independent agency.
- C. Sustainable Design Documentation Submittals:
 - 1. Credit MR 2: Comply with Division 01 Section "Construction Waste Management and Disposal."
 - 2. Credit MR 4: Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating cost for each product having recycled content.
 - 3. Credit MR 5: Product data for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
 - 4. Credit MR 7: Product data and chain-of-custody certificates for products containing certified wood. Include statement indicating cost for each certified wood product.
 - 5. Credit EQ 3.1:
 - a. Construction indoor-air-quality management plan.
 - b. Product data for temporary filtration media.
 - c. Product data for filtration media used during occupancy.

- d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.
 - 6. Credit IEQ 3.2:
 - a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
 - b. Product data for filtration media used during flush-out and during occupancy.
 - c. Report from testing and inspecting agency indicating results of indoor-air-quality testing and documentation showing compliance with indoor-air-quality testing procedures and requirements.
 - 7. Credit IEQ 4.1: Product data for adhesives and sealants used inside the weatherproofing system indicating VOC content of each product used.
 - 8. Credit IEQ 4.2: Product data for paints and coatings used inside the weatherproofing system indicating VOC content of each product used.
 - 9. Credit IEQ 4.4: Product data for products containing composite wood or agrifiber products or wood glues indicating that they do not contain urea-formaldehyde resin.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For LEED coordinator.
 - B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
 - 1. Plumbing.
 - 2. Mechanical.
 - 3. Electrical.
 - 4. Specialty items such as elevators and equipment.
 - 5. Wood-based construction materials.
 - C. Sustainable Design Action Plans: Provide preliminary submittals within 30 days of date established for commencement of the Work indicating how the following requirements will be met:
 - 1. Credit MR 2: Waste management plan complying with Division 01 Section "Construction Waste Management and Disposal."
 - 2. Credit MR 4: List of proposed materials with recycled content. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.
 - 3. Credit MR 5: List of proposed regional materials. Identify each regional material, including its source, cost, and the fraction by weight that is considered regional.
 - 4. Credit MR 7: List of proposed certified wood products. Indicate each product containing certified wood, including its source and cost of certified wood products.
 - 5. Credit IEQ 3.1: Construction indoor-air-quality management plan.
 - D. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with Sustainable Design action plans. Provide updated information submittal using LEED Online Template or spreadsheet, for the following LEED Credits sought for this Project:
 - 1. Material Costs per LEED guidelines:

- a. Credit MR 2: Waste reduction progress reports complying with Division 01 Section "Construction Waste Management and Disposal."
 - b. Credit MR 4: Recycled content.
 - c. Credit MR 5: Regional materials.
2. Total percentages of all permanently-installed wood value, for each item as it relates to the following credits.
 - a. Credit MR 7: Certified wood products.
3. Progress reports to be prepared within a comprehensive notebook documenting compliance for each LEED credit identified to accomplish.
 - a. Format LEED Documentation Notebook to match LEED numbering system and tabbed for each credit and prerequisite.
 - b. LEED documentation in notebook must contain up to date information through the previous month's work, and at least one set shall be available on the jobsite at all times.
 - c. Notebook may be maintained and available for reference electronically if preferred and as required for Closeout Submittal.
 - d. Completed pages shall be prevented from being altered.
 - e. If the Contractor fails to maintain the LEED Documentation Notebook as specified herein, the Owner or Architect will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the Notebook.
 - f. This monthly deduction will continue until an agreement can be reached between the Owner and the Contractor regarding the accuracy and completeness of the Notebook.
 - g. Submit two copies and an electronic version on CD of the notebook at project closeout.
 - h. Include updated LEED scorecard, applicable product data for material selection, final calculations, certifications for construction practices, procurement data, cumulative calculations and other items as identified in the approved LEED Action Plan.
 - i. Notebook must contain all required data to support full compliance with the indicated LEED credit.
 - j. LEED credits that are inherent to the design will be documented by the Architect.

1.7 CLOSEOUT SUBMITTALS

- A. Submit the following documentation in electronic format, at completion of construction and prior to contract closeout:
 1. Final waste management package per requirements of Section 017419.
 2. Final Materials and Resource Package: Provide individual electronic folders for Materials and Resources Credits 3, 4, 5 and 7 containing:
 - a. Legible electronic copies of relevant material product data for each product listed on the LEED Online Template.
 - b. Final PDF of completed LEED Online Template including the total project materials cost and a complete product list with costs demonstrating compliance with required level of achievement.
 3. Final Indoor Environmental Quality, Construction Indoor Air Quality Management package per requirements of this Section.
 4. Final Indoor Environmental Quality, Low Emitting Materials package per requirements of this Section.

- B. LEED Online: Final completed LEED Online Template and associated required documentation uploaded to LEED Online Project Database including:
 - 1. Legible electronic copies of relevant material product data for each product listed on the LEED Online Template.
 - 2. Final PDF of completed LEED Online Template including all low-emitting materials utilized on the Project.
 - 3. Materials and Resources Credit 2, Construction Waste Management: Section 017419.
 - 4. Materials and Resources Credit 4, Recycled Content.
 - 5. Materials and Resources Credit 5, Regional Materials.
 - 6. Materials and Resources Credit 7, Certified Wood.
 - 7. Indoor Environmental Quality Credits (this Section).

1.8 QUALITY ASSURANCE

- A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated.

2.2 RECYCLED CONTENT OF MATERIALS

- A. Credit MR 4: Building materials shall have recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content for Project constitutes a minimum of 20 percent of cost of materials used for Project.
 - 1. Cost of post-consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by total weight of the item and multiplying by cost of the item.
 - 2. Do not include plumbing, mechanical and electrical components, and specialty items such as elevators and equipment in the calculation.

2.3 REGIONAL MATERIALS

- A. Credit MR 5: Not less than 20 percent of building materials (by cost) shall be regional materials.

2.4 CERTIFIED WOOD

- A. Credit MR 7: Not less than 50 percent (by cost) of wood-based materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 1. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Heavy timber construction.

- d. Wood decking.
- e. Metal-plate-connected wood trusses.
- f. Structural glued-laminated timber.
- g. Finish carpentry.
- h. Architectural woodwork.
- i. Wood paneling.
- j. Wood veneer wall covering.
- k. Wood flooring.
- l. Wood lockers.
- m. Wood cabinets.
- n. Furniture.

2.5 LOW-EMITTING MATERIALS

- A. Credit IEQ 4.1: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
- 1. Wood Glues: 30 g/L.
 - 2. Metal-to-Metal Adhesives: 30 g/L.
 - 3. Adhesives for Porous Materials (Except Wood): 50 g/L.
 - 4. Subfloor Adhesives: 50 g/L.
 - 5. Plastic Foam Adhesives: 50 g/L.
 - 6. Carpet Adhesives: 50 g/L.
 - 7. Carpet Pad Adhesives: 50 g/L.
 - 8. VCT and Asphalt Tile Adhesives: 50 g/L.
 - 9. Cove Base Adhesives: 50 g/L.
 - 10. Gypsum Board and Panel Adhesives: 50 g/L.
 - 11. Rubber Floor Adhesives: 60 g/L.
 - 12. Ceramic Tile Adhesives: 65 g/L.
 - 13. Multipurpose Construction Adhesives: 70 g/L.
 - 14. Fiberglass Adhesives: 80 g/L.
 - 15. Contact Adhesive: 80 g/L.
 - 16. Structural Glazing Adhesives: 100 g/L.
 - 17. Wood Flooring Adhesive: 100 g/L.
 - 18. Structural Wood Member Adhesive: 140 g/L.
 - 19. Single-Ply Roof Membrane Adhesive: 250 g/L.
 - 20. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine-covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
 - 21. Top and Trim Adhesive: 250 g/L.
 - 22. Plastic Cement Welding Compounds: 250 g/L.
 - 23. ABS Welding Compounds: 325 g/L.
 - 24. CPVC Welding Compounds: 490 g/L.
 - 25. PVC Welding Compounds: 510 g/L.
 - 26. Adhesive Primer for Plastic: 550 g/L.
 - 27. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
 - 28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
 - 29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
 - 30. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 - 31. Other Adhesives: 250 g/L.
 - 32. Architectural Sealants: 250 g/L.
 - 33. Nonmembrane Roof Sealants: 300 g/L.
 - 34. Single-Ply Roof Membrane Sealants: 450 g/L.

35. Other Sealants: 420 g/L.
 36. Sealant Primers for Nonporous Substrates: 250 g/L.
 37. Sealant Primers for Porous Substrates: 775 g/L.
 38. Modified Bituminous Sealant Primers: 500 g/L.
 39. Other Sealant Primers: 750 g/L.
- B. Credit IEQ 4.2: For field applications that are inside the weatherproofing system, paints and coatings shall comply with the following VOC content limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Flat Paints and Coatings: VOC not more than 50 g/L.
 2. Nonflat Paints and Coatings: VOC not more than 150 g/L.
 3. Dry-Fog Coatings: VOC not more than 400 g/L.
 4. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
 7. Pretreatment Wash Primers: VOC not more than 420 g/L.
 8. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 9. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 10. Floor Coatings: VOC not more than 100 g/L.
 11. Shellacs, Clear: VOC not more than 730 g/L.
 12. Shellacs, Pigmented: VOC not more than 550 g/L.
 13. Stains: VOC not more than 250 g/L.
- C. Credit IEQ 4.4: Composite wood, agrifiber products, and adhesives shall not contain urea-formaldehyde resin.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

- A. Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.2 REFRIGERANT REMOVAL

- A. Prerequisite EA 3: Remove CFC-based refrigerants from existing HVAC&R equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in HVAC Sections.

3.3 CONSTRUCTION WASTE MANAGEMENT

- A. Credit MR 2: Comply with Division 01 Section "Construction Waste Management and Disposal."

3.4 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. Credit IEQ 3.1: Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction."
1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 01 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
 2. Replace all air filters immediately prior to occupancy.

3.5 INDOOR-AIR-QUALITY ASSESSMENT (CREDIT IEQ 3.2)

A. Flush-Out:

1. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity no higher than 60 percent.
2. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate determined in Prerequisite EQ 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.

B. Air-Quality Testing: Engage testing agency to perform the following:

1. Conduct baseline indoor-air-quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "Green Building Design and Construction Reference Guide."
2. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - a. Formaldehyde: 27 ppb.
 - b. Particulates (PM10): 50 micrograms/cu. m.
 - c. Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
 - d. 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
 - e. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
3. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from same locations as in the first test.
4. Air-sample testing shall be conducted as follows:
 - a. All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
 - b. Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
 - c. Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
 - d. Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION 018113

SECTION 019113 - GENERAL COMMISSIONING 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. Section Includes:

1. General Commissioning Requirements
2. Commissioning Process
3. Testing, Documentation, and Performance Requirements
4. Commissioning Plan

- B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submittal procedure requirements for commissioning process.
2. Section 017700 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.
3. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal requirements.
4. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
5. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
6. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.

1.3 REFERENCES

- A. Perform commissioning in accordance with relevant criteria documented in United States Green Building Council's (USGBC) Leadership in Energy Efficient Design (LEED) v3 commissioning requirements for Energy and Atmosphere (EA) prerequisite 1 and EA credit 3 and ASHRAE Guideline 0-2005 and Guideline 1.1-2007.

1.4 DESCRIPTION

- A. Commissioning is a systematic process of confirming, verifying and documenting that all building systems and process systems perform interactively according to the Owner's Program Requirements and the Basis of Design. The process starts during the design phase and continues through the construction, acceptance and warranty phases of the project.
- B. Commissioning during design is intended to achieve the following objectives:

1. Verify the Owner's Program Requirements and Basis of Design are clearly documented and they meet the Owner's goals and objectives.
 2. Provide Design Review during A/E design efforts.
 3. Verify commissioning for the construction phase is adequately reflected in the bid documents.
- C. Commissioning during the construction phase of this project is intended to achieve the following objectives:
1. Provide direction for the commissioning process during construction, provide resolution to deficiencies and assist in the development of details relevant to the commissioning process, and coordinate the flow of commissioning information.
 2. Verify and document that applicable equipment and systems are installed properly and receive operational checkout by installing contractors.
 3. Verify and document performance of equipment and systems.
 4. Review O&M and system performance documentation.
 5. Verify that the Owner's operating personnel are trained.
- D. The Commissioning process does not take away from or reduce the responsibility of the system designers to design a workable system nor the installing contractors to provide a finished and fully functioning product.
- E. The CxA directs and coordinates the commissioning activities and reports to the Owner. All members in the construction process work together to fulfill their contracted responsibilities and meet the objectives of the Owner's Project Requirements as detailed in the Contract Documents.
- F. The CxA works with the CM/GC according to established protocols to schedule the commissioning activities. The CxA will provide sufficient notice to the CM/GC and Owner for scheduling commissioning activities. The CxA will integrate these activities into the master construction schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.5 DEFINITIONS AND ABBREVIATIONS

A. Definitions:

1. Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.
2. Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.
3. Architect / Engineer (A/E): The prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.
4. Basis of Design (BOD): The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.
5. Building Automation System (BAS): The central building energy management control system (see Control System).
6. Commissioning authority (CxA): An independent agent, not otherwise associated with the A/E team members or the Contractor, though he/she may be hired as a subcontractor to them. The CxA directs and coordinates the day-to-day commissioning activities. The CxA does not take an oversight role like the CM.

7. Commissioning Plan: An overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.
8. Contract Documents: The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.).
9. Contractor: The general contractor or authorized representative.
10. Control System: The central building energy management control system (see BAS).
11. Construction Manager (CM): The Owner's representative in the day-to-day activities of construction. In general, the construction management services contractor (CM) is hired by the owner to assist the government in the overall management of the project including supervising and on-site managing authority over a project's construction. The General Contractor reports to the CM. The CM is the Owner's on-site representative.
12. Datalogging: Monitoring physical properties of operational parameters such as fluid flow rates, voltages, currents, status, and pressures of equipment using stand-alone dataloggers separate from the control system.
13. Direct Digital Control (DDC): Electronic monitoring and control of building systems, typically with a user-friendly user-interface. Uses Analog-to-Digital and Digital-to-Analog signal convertors. See Control System, BAS.
14. Deferred Tests: Any tests that are performed at a later date than the Acceptance Phase, and after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.
15. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or OPR or BOD. It does not perform properly or is not in compliance with the design intent.
16. Design Intent: A dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.
17. Design Narrative or Design Documentation: Sections of either the Design Intent or Basis of Design.
18. Factory Testing: Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.
19. Field Observation Report (FOR): Report that documents field observations made by CxA. Items may include:
 - a. Confirmation of progress or observations where no further action is required,
 - b. Observations of items of concern to the Owner that do not require tracking in the Issues Log;
 - c. Observations of non-conformance that will require tracking in the Issues Log.
20. First Of: Term used to designate the first installation of many. Typically used to designate such items as the first pipe hanger installed, the first light fixture installed, or the first insulation installed. Term is typically used to ensure that routine, high-volume installations are carried out in accordance with the required means and methods. Reviewing the first installation of many may prevent future re-work, coordination issues, and other non-compliant project performance issues.
21. Functional Performance Test (FPT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or automated monitoring methods. Functional testing culminates in the dynamic testing of systems (rather than just components) under operational conditions (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure set-point). Systems may be tested under various modes, such as during low or high cooling and heating loads, component failures, unoccupied conditions, or power failure. The systems are run through the control system's sequences of operation and components are verified to respond as specified in the control sequences. Traditional air or water test and balancing (TAB) is not functional testing, in the

commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified. Functional testing verifies and documents that the resultant system performance conforms to the OPR and BOD. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FPTs are performed after pre-functional checklists and start-up are complete.

22. General Contractor (GC): The prime contractor for this project. Generally refers to all the GC's subcontractors as well. Also referred to as the Contractor, in some contexts.
23. Indirect Indicators: Measurements or observations of a response or condition using a secondary observation rather than a direct observation.
24. Inputs/Outputs (IO): System of transducers, sensors and actuators used to monitor conditions (Inputs) or to operate or control equipment (Outputs). IO is connected to a controller which is typically part of a network of controllers which constitute a Building Automation System (BAS). IO can refer to the local controller, wiring from the controller to the field devices, and the field devices themselves.
25. Installation checklist: Documented field verification of equipment and system installation to ensure compliance with Manufacturer's installation requirements and construction documents. Carried out by Contractor on all commissioned equipment and systems. Checklist may be provided by Contractor and approved by CxA, or CxA may provide checklist for use by Contractor. Installation checklists are typically static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated).
26. Issues Log: Items not in compliance with commissioning requirements are tracked in the Issues Log. The Issues Log constitutes a formal, ongoing record of deficiencies, problems and concerns, and their resolution, raised by members of the Commissioning Team during the Commissioning Process.
27. Manual Test: Using portable or temporary instruments, control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
28. Mockup: Construction and testing of assemblies or sub-assemblies ahead of schedule, used for purposes of pre-approval by Cx Team. Assemblies may include completed work items from multiple trades and disciplines. Exact scope of mockups typically determined during a mockup scoping meeting.
29. Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.
30. Non-Compliance: See Deficiency.
31. Non-Conformance: See Deficiency.
32. Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."
33. Owner-Contracted Tests: Tests paid for by the Owner outside the GC's contract. These tests will not be repeated during functional tests if properly documented.
34. Owner's Project Requirements (OPR): Summary statement of the Owner's performance requirements for the project.
35. Pre-Functional Checklist (PFC): A list of items to inspect and elementary component tests to verify equipment is ready for functional testing. Pre-Functional checklists verify and augment the Contractor's installation and start-up checklist. Pre-Functional checklists are conducted by the CxA. Pre-Functional checklists may be conducted on a sample of commissioned equipment and systems, rather than on all equipment and systems.
36. Project Manager (PM): The contracting and managing authority for the owner over the design and/or construction of the project, a staff position.
37. Project Tests: See System Tests.
38. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.

39. Seasonal Performance Tests: Tests that are deferred until the system(s) will experience conditions closer to their design conditions.
40. Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair dryer to a space sensor to generate a response in a VAV box).
41. Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and BAS system to simulate a sensor value.
42. Specifications: The construction specifications of the Contract Documents.
43. Startup: The initial starting or activating of dynamic equipment, including execution of startup checklists.
44. Startup Checklist: Documented field verification of equipment and system startup and performance to ensure compliance with Manufacturer's operating requirements and construction documents. Carried out by Contractor on all commissioned equipment and systems. Checklist may be provided by Contractor and approved by CxA, or CxA may provide checklist for use by Contractor.
45. Subs: The contractors to the GC who provide and install building components and systems, conduct and document installation and startup checklists, assist CxA with testing of equipment and systems, and collaborate in the Cx process.
46. System Tests: An extension of FPT where all systems are operated concurrently under conditions that represent actual operational conditions as closely as possible. Various modes of operation (occupied, unoccupied, smoke exhaust, fire alarm, etc) and transitioning between operating modes are tested.
47. Test Procedures: See Test Protocol.
48. Test Protocol: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA.
49. Test Requirements: Requirements specifying what modes and functions, etc., shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents.
50. Trending: Monitoring using the building control system.
51. Vendor: Supplier of equipment.
52. Warranty Period: Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

B. Abbreviations:

- | | | |
|-----|---------|---|
| 1. | A/E | Architect and design engineers |
| 2. | ASHRAE | American Society of Heating, Refrigerating and Air Conditioning Engineers |
| 3. | BAS | Building Automation System |
| 4. | CC | Controls contractor |
| 5. | CM | Construction Manager (the owner's representative) |
| 6. | CxA | Commissioning Authority |
| 7. | Cx | Commissioning |
| 8. | Cx Plan | Commissioning Plan document |
| 9. | DDC | Direct Digital Control |
| 10. | EC | Electrical contractor |
| 11. | FPT | Functional performance test |
| 12. | GC | General contractor (prime) |
| 13. | HVAC | Heating, Ventilation and Air Conditioning |
| 14. | IO | Inputs and Outputs |
| 15. | LEED | USGBC's Leadership in Energy and Environmental Design |
| 16. | MC | Mechanical contractor |
| 17. | MEP | Mechanical, Electrical and Plumbing |
| 18. | O&M | Operations and Maintenance |

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- 19. OPR Owner's Project Requirements
- 20. PC Plumbing contractor
- 21. PFC Pre-functional checklist
- 22. PM Project manager (of the Owner)
- 23. Subs Subcontractors to General
- 24. TAB Test, Adjust and Balance
- 25. TABC Test, Adjust and Balance contractor
- 26. USGBC United States Green Building Council

1.6 COMPENSATION

- A. If the Commissioning Authority, Owner's staff, or representative perform additional services or incur additional expenses due to Non-Conformance, the contractor must provide compensation for such additional services and expenses as defined in Section 1.13 Non-Conformance.

1.7 COMMISSIONING TEAM

- A. The members of the commissioning team consist of representatives of the
 - 1. Commissioning Agent (CxA).
 - 2. Owner (PM, O&M, Operator, Occupants).
 - 3. Architect.
 - 4. MEPFP Design Engineers.
 - 5. Contractor (CM or GC).
 - 6. Sub-Contractors (EC, MC, PC, CC, TABC).
 - 7. Other Consultants (eg: LEED or sustainability, Acoustics).
 - 8. Other Subs-Contractors and Vendors (eg: Security, Fire Alarm).

1.8 INFORMATIONAL SUBMITTALS

- A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedure general requirements for commissioning process.
- B. Provide regularly updated Construction Schedules, both long term and short term (look-ahead), with Commissioning activities included.
- C. Reports and Checklists:
 - 1. Installation and Start-Up Checklists: Prior to startup of equipment or a system, submit signed, completed construction checklists.
 - 2. Training Plan

1.9 COORDINATION

- A. Commissioning Kick-Off Meeting, Construction Team: Contractors will attend a meeting of the Commissioning Team, chaired by the CxA, to review the scope of commissioning process activities and the Commissioning Plan with discussions on milestones, activities, and assignments of responsibilities. The flow and type of documents and the amount of submittal data given to the CxA will be determined. Meeting minutes will be distributed to the Cx team by the CxA.

- B. Commissioning Meetings: Contractors will attend coordination meetings with the Commissioning Team, chaired by the CxA, to review progress on the Commissioning Plan, construction deficiencies, scheduling conflicts, and to discuss strategies and processes for upcoming commissioning process activities.
- C. Miscellaneous Construction Meetings: The CxA attends selected planning and job-site meetings in order to remain informed on construction progress and to provide updates on the commissioning process to the Cx team.
- D. Pre-testing Meetings: Contractors will attend pretest meetings with the Commissioning Team, chaired by the CxA, to review startup reports, pre-test inspection results, testing procedures, test instrumentation requirements, and Manufacturers' authorized services for systems and subsystems to be tested.
- E. Testing: Contractors will coordinate testing resources and witnessing of test procedures by Cx team.
- F. Manufacturers' Inspection and Startup Services: Contractors will coordinate services of Manufacturers' inspection and startup services with the Cx team.
- G. Testing, Adjusting and Balancing: Contractors will coordinate with TABC services to allow Cx team to witness test procedures.

1.10 PROCESS

- A. The following narrative provides a brief overview of the commissioning tasks during construction and the general order in which they occur. A detailed description of commissioning tasks is presented in the Commissioning Plan. A Preliminary Cx Plan Summary is included as an attachment to this specification and will be presented to the GC and Subs for review prior to, or during the Commissioning Kick-Off Meeting. The CxA continues to update the plan as the project progresses.
 - 1. Commissioning during construction begins with a Commissioning Kick-Off Meeting, Construction Team, conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
 - 2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
 - 3. Equipment documentation, including detailed start-up procedures, is submitted to the CxA through the submittal process.
 - 4. In general, the checkout and performance verification proceeds from simple to complex; with tests progressing from components to equipment to sub-systems to systems to project level tests. Pre-functional checklists being completed before functional testing begins.
 - 5. No equipment, sub-system or system shall progress to the next level of testing until the preceding tests have satisfied the test requirements.
 - 6. Items that do not meet the test requirements shall be tracked in the Issues Log. Issues Log items shall be reviewed at Cx meetings.
 - 7. The CxA verifies installation integrity thru the use of installation and startup checklists. The contractors perform and document the installation and startup checkout. The CxA may witness start-up of selected equipment.
 - 8. The CxA develops specific equipment functional performance test procedures. The contractors review the procedures.

9. The functional testing procedures are executed by the contractors, under the direction of, and documented by the CxA.
10. System-level and project tests are the last level of testing required to secure acceptance of the project by the Owner.
11. Items of non-compliance in material, installation or setup are corrected at the contractor's expense and the system retested.
12. The CxA reviews the O&M documentation for completeness.
13. The testing phase of commissioning is completed before Substantial Completion, whenever possible.
14. The CxA reviews and pre-approves the training plan provided by the contractors.
15. The contractors coordinate and provide training via qualified instructors.
16. Training of Owner's representatives and O&M personnel will occur during the acceptance and substantial completion phase of the project. Selected training sessions may occur at any point during the construction phase.
17. At the conclusion of each training session, attendees sign the attendance log, and the Owner confirms that satisfactory training has occurred.
18. Deferred testing and seasonal testing is conducted, as specified or required.

1.11 RESPONSIBILITIES

A. Owner's Responsibilities:

1. Provide the OPR documentation to the CxA and Contractors for use in developing the Commissioning Plan, testing plans and checklists.
2. Distribute the Basis of Design documents, prepared by the architect and approved by the Owner, for use in developing the Commissioning Plan, testing plans and checklists.
3. Assign operation and maintenance personnel and schedule them to participate in Commissioning Team activities including, but not limited to, the following:
 - a. Commissioning meetings.
 - b. Construction phase coordination meetings.
 - c. Piping and ductwork testing and flushing verification meetings.
 - d. Procedures meeting for testing, adjusting and balancing.
 - e. Testing and demonstration of equipment, sub-systems and systems.
 - f. Training in operation and maintenance of equipment, sub-systems and systems.
 - g. Final review and acceptance meetings.
4. Provide utility services required for the commissioning process.
5. Facilitate the coordination of the commissioning work between the CxA, the Contractor and the Architect and Engineers to ensure that the commissioning activities are incorporated into the master schedule.
6. Review and approve the commissioning plan.
7. Coordinate any seasonal or deferred testing.
8. Ensure that any seasonal, deferred testing and/or deficiency issues are addressed.
9. Facilitate and support energy measurement and verification efforts.

B. Design Professional's Responsibilities:

1. Attend the Commissioning Kick-Off Meeting and selected Cx meetings.
2. Perform submittal review, construction observation, as-built drawing preparation, other items as contracted.
3. Create the Basis of Design Document. The designers, along with the contractors shall assist the CxA by clarifying the operation and control of commissioned equipment in

areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

4. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
5. Prepare construction Record documents and specifications.
6. Ensure that the CxA's submittal comments are incorporated into the Design Professional's submittal comments prior to sending to CM or GC for distribution.
7. Provide facility operating procedures for normal, abnormal, and emergency modes of operation and other, project-specific modes.
8. Participate in resolution of design non-conformance and design deficiencies identified during the warranty-period commissioning process..

C. Contractor's Responsibilities:

1. Attend commissioning kick-off meeting and selected Cx team meetings.
2. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities. Activities may include, but are not limited to, the following:
 - a. Facilitate the coordination of commissioning and incorporate commissioning activities into the overall project.
 - b. Provide copies of all applicable submittals as required in Division 01 including all changes thereto.
 - c. Provide detailed startup schedule and equipment and system startup procedures.
 - d. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, perform corrective actions.
 - e. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
 - f. Attend commissioning team meetings held on a scheduled basis.
 - g. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CxA. Furnish a copy of the O&M literature to the CxA forty five (45) days after final equipment submittals.
 - h. In each purchase order or subcontract written, include requirements for submittal data, O&M literature, commissioning tasks and training.
 - i. Integrate and coordinate commissioning process activities with construction schedule.
 - j. Review and accept construction checklists provided by the CxA.
 - k. Review and accept commissioning process test procedures provided by the CxA.
 - l. Complete commissioning process test procedures.
 - m. Create, maintain and distribute trend logs for the purposes of documenting equipment and system performance measures, throughout the Cx process.
 - n. Submit training plan for approval, coordinate training with Cx team and provide qualified instructors for training of Owner personnel.
 - o. Assist the CxA as necessary in the seasonal testing, deferred testing and deficiency resolution.
 - p. Correct deficiencies and make necessary adjustments to submittals, O&M manuals and red-lined drawings for applicable issues identified in any seasonal testing.
 - q. Provide recommended schedule of maintenance requirements and frequency.
 - r. Provide written as-built controls drawings and sequences of operation for all equipment.
 - s. Provide a written list of time of day schedules and a schedule frequency to review them for relevance and efficiency.

- t. Provide written recommendations for recalibration frequency of sensors and actuators by type and use.
- u. Provide a written list of all user adjustable set-points and reset schedules with a brief discussion of the purpose of each and the range of reasonable adjustments with energy implications.
- v. Provide a written schedule of frequency to review the various set-points, reset schedules, and their values to ensure they are current, relevant and efficient.
- w. Provide a written list of diagnostic tools with use descriptions to assist facility staff.
- x. Clearly identify and document all major building, zone and equipment means of isolation and disconnect (eg: shut-off valves, disconnect switches) on the as-built drawings.

D. Equipment Suppliers Responsibilities:

- 1. Provide all requested submittal data necessary and required to keep warranties in force, including detailed start-up procedures and specific responsibilities of the Owner.
- 2. Assist in equipment testing per agreements with subcontractors.
- 3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

E. Commissioning Authority Responsibilities:

1. Roles and Responsibilities:

- a. The CxA is not responsible for the design concept, the design criteria, compliance with codes, design or general construction scheduling, cost estimating or construction management. The CxA may assist with problem solving and non-conformance items or deficiencies, but the CxA is not the Design Engineer / Engineer of Record, and the commissioning process does not preclude the Design Engineer / Engineer of Record of responsibilities for system evaluations, adequacy of systems to meet the OPR, capacities of systems, quality control checks, or any of the other elements and recommended final acceptance of systems to the Owner.
- b. The primary role of the CxA is to coordinate and direct the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultants with all necessary parties, frequently updated timelines and schedules and technical expertise.

2. Commissioning Plan:

- a. A Preliminary Cx Plan Summary is included as an attachment to this specification.
- b. The Commissioning Plan shall be a "living document" in which information is added to or modified by the Commissioning Team during the course of the Project.

3. Document Review:

- a. Review the Owner's Project Requirements and Basis of Design developed by the design professionals.
- b. Perform a focused review of the drawings and specifications during or prior to mid-Construction Document Phase.
- c. Develop general commissioning specifications for all systems and equipment to be commissioned.
- d. Review submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E's reviews.

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4. Cx Team Meetings:
 - a. Commissioning during construction will begin with a 'Commissioning Kick-Off Meeting for Construction Team' conducted by the CxA where the commissioning process is reviewed with all of the commissioning team members.
 - b. Additional meetings will be required throughout construction as necessary to plan, scope, coordinate, and schedule future activities and resolve problems.
5. Coordination and Scheduling:
 - a. Coordinate and direct commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications, and consultations with all necessary parties.
 - b. Coordinate commissioning work with the CM/GC to ensure that commissioning activities are being scheduled into the master project schedule.
6. Issue/Deficiency Logs:
 - a. The CxA shall prepare a formal, ongoing record of deficiencies, problems and concerns, and their resolution, raised by members of the Commissioning Team during the Commissioning Process.
 - b. Issues will be revisited one (1) time to verify that the proper corrections have been made. The Owner reserves the right to deduct from the Contractors' contract costs associated with additional revisits required for outstanding issues.
 - c. When issues are resolved, they will be closed on the Issues Log by the CxA.
7. Commissioning Progress:
 - a. Issue Field Observation Reports documenting site visit observations.
 - b. Attend selected planning and jobsite meetings to obtain information on construction progress.
 - c. Review construction meeting minutes for revisions/substitutions relating to the commissioning process.
8. Field Observations:
 - a. Perform site visits, as necessary, to observe component, equipment and system installations.
 - b. Review First Of installations.
 - c. Document construction process and compare against critical path for completion of Cx Plan.
9. Infra-structure tests:
 - a. Review and approve the infra-structure test plan (e.g., pipe testing, flushing and cleaning) submitted by the Contractor.
 - b. Witness all or part of infrastructure tests and be sufficiently confident that proper procedures are being followed.
10. Pre-Functional Checks: Installation and Startups:
 - a. Witness selected equipment and system installation and startup checks.
11. Third-Party Testing:

- a. Review the third-party testing (e.g., TAB) plan for the project, which shall be submitted by the appropriate consultants, subs or vendors.
 - b. Verify and document the accuracy of the third-party testing by witnessing, spot testing, or by reviewing completed reports.
12. Functional Performance Testing With the assistance of the Cx team:
- a. CxA writes Functional Performance Testing procedures applicable to all components, equipment and systems to be commissioned.
 - b. Conducts FPT on a sample of installed equipment and systems.
 - c. Coordinate Functional Performance Testing.
 - d. Direct, witness and approve Functional Performance Testing performed by the Contractors.
 - e. Coordinate retesting to achieve acceptable performance.
13. System and Project Testing With assistance of the Cx team:
- a. CxA writes System Testing procedures applicable to all components, equipment or systems to be commissioned.
 - b. Coordinate System Testing.
 - c. Direct, witness and approve System Testing performed by the Contractors.
 - d. Coordinate retesting to achieve acceptable performance.
14. Seasonal and Deferred Testing With assistance of the Cx team:
- a. CxA writes updated Testing procedures applicable to all components, equipment or systems to be tested.
 - b. Coordinate Seasonal and Deferred Testing.
 - c. Direct, witness and approve Seasonal and Deferred Testing performed by the Contractors.
 - d. Coordinate retesting to achieve acceptable performance.
15. Commissioning Final Report:
- a. The CxA shall provide a final report following the completion of Testing, excluding seasonal and deferred Tests. Seasonal and deferred test results shall be attached to or inserted in the final report in a clear and readily identified manner. The report is to outline compliance and non-compliance with the construction documents, as well as identify concerns relative to future performance
16. Operation and Maintenance Data:
- a. The CxA shall review the documentation submitted by the Contractor as required by the Specifications for completeness and accuracy. This commissioning review supplements, but does not replace, the Architect/Engineer's review.
 - b. The CxA will make suggestions for improvements in the content of the O&M Manuals. Any required changes shall be made by the contractor responsible for that section.
 - c. Review equipment warranties to ensure that the Owner's responsibilities necessary to maintain warranty coverage are clearly defined.
17. Training:

- a. The CxA will verify through the Contractor's plan and schedule, training agendas, and select observations that proper training procedures were followed on all commissioned systems.
- 18. Systems Manual Requirements: CxA shall compile electronic copies and/or hard-copies of documentation into a System Manual containing the following:
 - a. Index of Systems Manual with notation as to content storage location if not in actual manual.
 - b. Executive Summary.
 - c. Final OPR and BOD.
 - d. System one-line diagrams.
 - e. As-built sequences, control drawings and values of adjustable parameters (e.g. schedules, set-points, time-delays).
 - f. Operating instructions for integrated building systems.
 - g. A list of recommended operational record keeping procedures at the facility level, including sample forms, trend logs, or others, and a rationale for each.
 - h. Maintenance requirements, procedures, schedules and recommendations.
 - i. Ongoing optimization.
 - j. Re-calibration schedule.
- 19. Post Occupancy Review:
 - a. The CxA will return to the site within the 12-month warranty period to address:
 - 1) Review current building operations with facility staff and address outstanding issues related to the Owner's Project Requirements.
 - 2) Interview facility staff and identify problems or concerns with operating the building.
 - 3) Identify problems covered under warranty or under the original construction contract.
 - b. The CxA shall assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
- 20. Cx Report Addenda:
 - a. The CxA will issue Addenda to the Cx Report to ensure that any relevant Cx process documentation that is obtained after the initial Cx Report is issued is included with the Cx Report.

1.12 TEST DEFICIENCIES

A. Deficiencies/Non-Conformance:

- 1. The CxA will record the results of the functional tests. Deficiencies and non-conformance items shall be noted and reported to the Owner and Contractors using the Issues Log.
- 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA.
- 3. Efforts will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
- 4. When a deficiency is identified, the CxA discusses the issue with the executing contractor.

5. When there is no dispute on the deficiency and the contractor accepts responsibility to correct it, the CxA documents the deficiency and the contractor's response and intentions or corrections. The CxA and contractor then proceed to another test or sequence. Once the contractor corrects the deficiency, the test is rescheduled and repeated.
6. When there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible, the CxA documents the deficiency and the contractor's response. The deficiency is then forwarded to parties assumed to be responsible for the deficiency. Resolutions are made at the lowest management level possible. Other parties are brought into the discussion as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner and CxA. The CxA will then document the resolution process. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency. The CxA then reschedules the test as stated in the section above. Costs of retesting are as stated below in the applicable section.

1.13 NON-CONFORMANCE

A. Cost of Retesting:

1. The cost for the Contractor to retest a Pre-functional or Functional Performance Test, if they are responsible for the deficiency, shall borne by the responsible contractor. If the Contractor is not responsible, any cost recovery for retesting costs shall be negotiated with the CM/GC.
2. For a deficiency identified and not related to any Pre-functional checklist or Startup fault, the following shall apply: The CxA will direct the retesting of the equipment once at no additional cost to the CM/GC for the CxA's additional time. However, the CxA's and Owner's time for a second retest will be charged to the CM/GC, who may choose to recover costs from the responsible contractor or subcontractor. Before retesting occurs, the CM/GC will inspect the deficiency and respond to the CxA that the issue has been addressed.
3. The time for the CxA and owner to direct any retesting required because a specific Pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the CM/GC, who may choose to recover costs from the party responsible for misinformation or deficiency.
4. The contractor shall respond in writing to the CxA and owner at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
5. Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the CM/GC, contractors or subcontractors.
6. Failure due to Manufacturer Defect or Improper Installation
 - a. If 10% or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM/GC, CxA or Owner. In such case, the Contractor shall provide the Owner with the following:
 - 1) Within one week of notification from the CM/GC or Owner, the Contractor or Manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM/GC or Owner within two weeks of the original notice.

- 2) Within two weeks of the original notification, the Contractor or Manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc., and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
 - 3) The CM/GC, CxA or Owner will determine whether a replacement of all identical units or a repair is acceptable.
 - 4) Two examples of the proposed solution will be installed by the Contractor and the Contractor will be allowed to test the installations for up to one week, upon which the CxA or Owner will decide whether to accept the solution.
- b. Upon acceptance, the Contractor and/or Manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
7. Approval:
- a. The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA. The CxA recommends acceptance of each test to the Owner using a standard form.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 MANAGEMENT

- A. The CxA shall finalize the Commissioning Plan at the start of the project, after critical submittals have been approved and a detailed construction and startup schedule has been developed by the CM/GC. The Commissioning Plan shall outline the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.
- B. CxA shall distribute meeting minutes containing topics discussed, attendees and attachments reflecting materials handed out during the meeting.
- C. CxA shall maintain an Issues Log which shall document the specific attributes of potential project deficiencies.

3.2 TESTING

- A. Mockup:
 1. Selected equipment and systems will be tested ahead of the overall construction schedule, for purposes of pre-approval by Cx Team. Assemblies will include completed work items from multiple trades and disciplines. Temporary control power will be required to test and verify performance of BAS controllers in stand-alone mode and associated control and monitoring devices (eg: actuators, sensors).

B. Installation and Startup Checklists:

1. Installation and startup checklists are important to ensure that the equipment and systems are installed and operational. They ensure that functional performance testing may proceed without unnecessary delays. Each piece of equipment receives full checkout by the Contractor.

C. Functional Performance Tests:

1. The installing contractors, under the direction of the CxA, shall perform Functional Performance Testing of systems and sub-system performance after Pre-Functional checks have been completed and all outstanding issues resolved.
2. The installing contractor will perform tests specified in this and related sections.
3. Verify and test performance using actual conditions whenever possible.
4. Simulate conditions by imposing an artificial load when it is not practical or feasible to test under actual conditions. Document simulated conditions and methods of simulation. After test, return settings to normal operating conditions.
5. Alteration of set points or over-writing of points may be required when simulating conditions is not practical.
6. The CxA shall witness and document the results of functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Contractors for review and comment.

D. System Tests:

1. The installing contractors, under the direction of the CxA, shall perform System Tests after Functional Performance Tests have been completed. System Tests shall test and document facility systems operation concurrently and under real-world, or simulated real-world operating conditions.
2. System Tests shall be conducted under all applicable or appropriate facility modes of operation. Specific items of interest include, but are not limited to, process equipment static pressure control, process flow control,, and equipment staging and cycling.
3. The CxA shall witness and document the results of System Tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Contractors for review and comment.
4. Where scheduled Owner operation prevents, precludes or precedes execution of System Tests, Contractors shall assist Commissioning Team during Owner occupied operation of systems.

E. Seasonal/Deferred Testing:

1. Deferred Testing: If any check or test cannot be completed during the Functional Performance testing phase then execution of checklists and functional testing may be delayed upon approval of the Owner. These tests will be conducted as soon as possible. Services of necessary parties may need to be negotiated.
2. Seasonal Testing: Seasonal testing shall be completed with the assistance of the Contractor as part of this contract, even if it occurs during the warranty period. The CxA shall coordinate this activity with the Cx team. Tests will be executed, documented and deficiencies corrected by the appropriate members of the Commissioning Team, with facilities staff and the CxA witnessing. When warranted by the test results, Contractor will make necessary adjustments to the O&M manuals and record documents to ensure their continued accuracy.

F. Test Equipment:

1. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system in Division 23, except for equipment specific to, and used by the TABC in their commissioning responsibilities. A sufficient quantity of two-way radios shall be provided by each subcontractor.
2. Special equipment, tools and instruments (specific to a piece of equipment and only available from the vendor) required for testing shall be included in the base bid price to the Owner and left on site. Equipment supplied or used by the CxA is exempted from this requirement.
3. Proprietary test equipment and software required by any equipment Manufacturer for programming and/or start-up, whether specified or not, shall be provided by the Manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.
4. Test equipment and software provided by the CxA shall not become the property of the Owner.
5. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
6. Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F.
7. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

3.3 REPORTING

A. Progress Reports:

1. The CxA will provide regular reports to the Owner, at a frequency commensurate with the project schedule and Cx activities.
2. CxA shall distribute Task Status reports that indicate completion rates of primary commissioning tasks for Contractor and CxA.

B. Final Report:

1. The Cx Report includes overviews and detailed information on the Cx process. Report is issued after Substantial Completion. Commissioning activities completed subsequent to issuance of the Cx Final Report shall be issued as addenda, as necessary.

3.4 TRAINING

- A. The CM/GC and contractors shall be responsible for training coordination, scheduling and ultimately for ensuring that training is completed.
- B. The CxA shall oversee the training of Owner's personnel for commissioned equipment and systems.
- C. The CxA shall interview the Owner's staff to determine the special needs and areas where training will be most valuable. The Owner, with the assistance of the CxA, shall decide the rigor of the training for commissioned equipment and systems.

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- D. Each Sub and vendor responsible for training will submit a written training plan to the CM/GC and/or contractors for review and approval prior to training. The CM/GC and/or contractors will submit one comprehensive training plan to the CxA and Owner.
- E. The training plan will be reviewed by the CxA and Owner. Comments pertaining to its deficiencies will be forwarded to the CM/GC and Contractors. The training plan will be rewritten until approved by the CxA and Owner. The final approved training plan will cover the following elements:
 - 1. Equipment (included in training).
 - 2. Intended audience.
 - 3. Location of training.
 - 4. Objectives.
 - 5. Subjects covered (description, duration of discussion, special methods, etc.).
 - 6. Duration of training on each subject.
 - 7. Qualified instructor for each subject.
 - 8. Instructor qualifications.
 - 9. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, hands-on, etc.).
- F. For selected primary HVAC equipment, the CC shall provide a discussion of the control of the equipment as part of the equipment training.
- G. The CxA develops criteria for determining that the training was satisfactorily completed, including attending selected training sessions. The CxA recommends approval of the training to the Owner. The Owner signs the approval form/letter template.
- H. At one of the training sessions, the CxA presents a presentation discussing the use of the blank functional test forms for re-commissioning equipment.
- I. Video taping of the training sessions in DVD format will be provided by the CM/GC, with tapes cataloged by the CM/GC and added to the O&M manuals, if required by Division 01 specifications.
- J. The mechanical design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall be one to two hours in length and include a review of mechanical (HVAC and Plumbing) systems using the simplified system schematics (one-line drawings).
- K. The electrical design engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall be one to two hours in length and include a review of electrical systems using the simplified system schematics (one-line drawings).

3.5 SYSTEMS TO BE COMMISSIONED

- A. Refer to the following spec sections for Systems to be Commissioned
 - 1. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
 - 2. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.

3. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.
- B. A complete list of commissioned systems and equipment cross-referenced to plan marks on record drawings will be distributed at the Commissioning Kick-Off Meeting.

3.6 BAS / CONTROLS CHECKLISTS

- A. Control Systems Startup shall include the following items in addition to what is specified in Division 23 and 26 Sections.
 1. A Pre-functional checklist (PFC) of every hardwired input and output control point on the BAS will be completed by the CC.
 2. Wireless sensors shall be treated as if they were hardwired.
 3. PFC of BAS will verify points are functioning as per design documents, construction records and installation guidelines.
 4. PFC will check both hardware and software configurations for compliance with design documents, construction records and installation guidelines.
 5. PFC completed by CC shall include the following information for each controller and all control points connected to the controllers:
 - a. Controller address.
 - b. Controller name or descriptor.
 - c. Point name.
 - d. Point identifier, unique to controller.
 - e. Point monitoring or measured control variable (examples: Temperature, Pressure, Status, Speed, Position).
 - f. Point unit of measurement (examples: degrees Fahrenheit, inches water column, Hertz, % Open).
 - g. Point raw, unadjusted IO signal range defined by minimum and maximum values (examples: 0 – 10Volt-DC, 4-20mA, 0-5Vdc).
 - h. Point adjusted, final value (examples: -200 to +200°F, +/-0.5"WC, 0-60Hz, 0-100% Open).
 - i. Point state (manual or automatic).
 - j. Point PFC passed or failed.
 - k. Time and date of each point PFC occurrence.
 6. Input Control points shall be tested at expected field minimum and maximum values of range and at typical field values.
 7. Output Control points shall be tested at minimum and maximum value of range.
 8. The individual carrying out PFC on behalf of CC shall initial each individual IO point PFC.
 9. CC shall provide typed list of personnel names and initials used to carry out PFCs.
 10. CC shall exercise proper safety precautions to ensure controlled equipment is not damaged by control point tests.
 11. CC shall obtain approval of input control point testing forms and methods prior to executing PFC.
 12. CC shall provide sufficient notice for CxA to witness PFCs.

3.7 BAS REPORTING AND DATA LOGGING

- A. Environmental control parameters (eg: temperature, volumetric balancing).
 1. Parameters shall be displayed in dynamic reports on a zone, floor and building level.

**Interdisciplinary Science Building
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2. Parameters shall include summary statistics on a zone, floor and building level.
3. Parameters shall be available in pre-configured trend-log reports containing multiple parameters.

B. Process equipment and infrastructure monitoring and control points (eg: equipment monitoring and control points, pipe pressures).

1. Monitoring and control points shall be displayed in dynamic reports on both an individual piece of equipment and combined equipment use level..
2. Equipment monitoring and control point summaries shall be provided for each piece of equipment.
3. Alarm summary screens shall be provided for each alarm type, and detailed alarm screens shall be provided to allow operator resolution of alarms down to the individual alarm condition.

3.8 PRELIMINARY CX PLAN

- A. See attachment to specification titled "Preliminary Cx Plan."

3.9 SAMPLE TEST PROTOCOLS

- A. Sample test protocols are included in the attachment to specification titled "Preliminary Cx Plan".

END OF SECTION 019113

Preliminary Commissioning Plan

Client:

Webster University

Project:

Interdisciplinary Science Building

Owner:

Webster University

Commissioning Services by:

Ross & Baruzzini
6 South Old Orchard Ave.
St. Louis, MO 63119

R&B Project No: 1136-16
March 1, 2016

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1 Introduction

Commissioning (Cx) describes a quality oriented process that is used to ensure and verify that systems operate predictably and efficiently in support of the Owner's goals. The Cx Plan defines the processes and tasks used to carry out the Cx process. The Cx Plan is a living document and evolves with the project as it moves from the design phase to the construction phase, the testing phase and the operation & occupancy phase. This preliminary plan identifies multiple items which still need to be defined. A final Cx Plan will be issued once construction is under way.

Commissioning completes the following tasks for the project phases identified.

Design Phase

- Develop and manage the OPR.
- Conduct review of the Basis of Design (BoD), 100% Schematic Design documents, 100% Design Development documents, and 95% Construction documents.
- Identify incentive program opportunities.
- Develop Cx Specifications.
- Develop a Preliminary Cx Plan.

Construction Phase

- Review submittals for compliance with OPR, BoD and Cx Plan.
- Review project transfer and close-out activities, including training and project documentation.
- Review and assist in development of construction quality assurance and quality control procedures.

Testing Phase

- Conduct preventive testing during construction.
- Ensure final equipment and systems are ready for Functional Performance Tests (FPTs).
- Conduct performance tests at equipment, system and project levels and evaluate results.
- Report Cx results to Owner.

Operation and Occupancy Phase

- Review, witness and participate in project transfer activities to ensure successful project operation.
- Participate in review of project operation during the warranty phase.
- Prepare the United States Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED) Cx submittals.

The Cx Plan is developed in three phases. A Summary Cx Plan is developed along with the initial Cx proposal. The Summary Cx Plan is a single page table of tasks and responsibilities that are listed in chronological order for each of the Cx phases of the project: Design, Construction, Testing, and Operation and Occupancy.

A Preliminary Cx Plan is developed during the design phase and included with the specifications. The Preliminary Cx Plan provides a guideline for the Cx activities that are planned for the construction phase.

The Final Cx Plan is developed during the Construction phase of the project. There are three critical items that drive the changes between the Preliminary and Final Cx Plan. These items are the final construction document updates, approved submittals, and a final construction schedule. The Final Cx Plan and its implementation requires close coordination with the construction effort.

2 Project Overview

The project owner, Webster University (WU) requested commissioning (Cx) services for a new campus building. This project is to consist of a new 4-story interdisciplinary science building, which houses classrooms, laboratories, offices, and collaboration spaces. The primary occupants will be the Nursing, Biology, Physics, Chemistry, and Social Science departments.

Project Name:	Interdisciplinary Science Building
Address or Location:	8274 Big Bend Blvd. Webster Groves, MO 63119
Size and configuration:	85,000 sf with 4 floors
Occupancy Type:	Classrooms, laboratories, offices, and collaboration spaces.
Occupants:	Nursing, Biology, Physics, Chemistry, and Social Sciences departments
Owner:	Webster University
R&B Project #:	1136-16
Design Period	May 2015 to March 2016
Construction Period:	April 2016 to August 2017

3 Cx Team

3.1 Owner

Owner	Webster University
Owner's representatives	Kenneth Creehan, Director of Process Improvement Phone: 314-968-6969 Email: creehan@webster.edu Craig Miller, Director, Facilities Planning Phone: 314-246-7773 Email: craigmiller29@webster.edu Gilbert Morales, Manager, Facilities Operations Phone: 314-968-7424 Email: moralesg@webster.edu

3.2 Design Team

Architect (A)	Cannon Design Richard Bacino Phone: 314-495-0496 Email: rbacino@cannondesign.com Lynn Grossman Phone: 314-288-5257 Email: lgrossman@cannondesign.com
MEP Engineer (MEP)	William Tao & Associates, Inc Patrick Garner Email: pgarner@wmtao.com Mark Schaefer Phone: 314-348-3574 Email: mschaefer@wmtao.com
LEED Consultant	- - Phone: Email:

3.3 Contractor Team

General Contractor (GC)	Paric Construction Company Todd Sweeney Phone: 314-458-3738 Email: TASweeney@paric.com
Mechanical / Plumbing Contractor (MC)	Not under contract, yet [Contact Name] Phone: Email:
Electrical Contractor (EC)	Not under contract, yet [Contact Name] Phone: Email:
Controls Contractor (CC)	Not under contract, yet [Contact Name]

	Phone: Email:
Test, Adjust & Balance Contractor (TABC)	Not under contract, yet [Contact Name] Phone: Email:

3.4 Commissioning Authority

Commissioning Authority (CxA)	Ross & Baruzzini Phone: (314) 918-8383 Ryan Walsh Phone: (314) 518-2629 Email: rwalsh@rossbar.com Marijn Braadbaart Phone: (314) 363-8212 Email: mbraadbaart@rossbar.com Clay Wiedner Phone: (618) 623-8535 Email: cwiedner@rossbar.com Kevin McCormick Phone: (314) 703-2695 Email: kmccormick@rossbar.com
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4 Systems and Equipment

The Cx process activities shall be completed for the following systems. The list of specific systems and equipment is developed based on the BP2 Preview Set dated 02/05/2016. The design drawings have discrepancies between equipment schedules and riser diagrams. Equipment quantities and Cx sample rates will be finalized as part of the Final Cx Plan.

4.1 Mechanical

Systems and Equipment	Total Quantity	Sample Rate
Building Chilled Water System		
Building Chilled Water Loop Pump (CP)	2	2 (100% Sample)
Process Chilled Water Pump	1	1 (100% Sample)
Process Heat Exchanger (PHX) (Water to Water)	1	1 (100% Sample)
Hydronic Specialties (e.g. Expansion Tanks, Air Separators, Valves)	-	-
Heating Hot Water System		
Boilers	2	2 (100% Sample)
Hot Water Pumps (HWP)	2	2 (100% Sample)
Hydronic Specialties (e.g. Expansion Tanks, Air Separators, Chemical Feeders)	Pending final CDs	X (Y% Sample)
Primary Air Systems		
Air Handling Units (AHU)	4	4 (100% Sample)
Split System Fan Coil (FCU)	Pending final CDs	- (100% Sample)
Air-Cooled Condensing Unit (ACCU)	Pending final CDs	- (100% Sample)
Lab Exhaust Fan (HEF)	3	1 (100% Sample)
Toilet Exhaust Fan (EF)	1	1 (100% Sample)
Building Relief Exhaust Fan (EF)	1	1 (100% Sample)
Kitchen Exhaust Fan (KEF)	1	1 (100% Sample)
Heat Recovery Systems		
Heat Recovery Pump (HRP)	2	2 (100% Sample)
Heat Recovery Coil (HRC)	1	1 (100% Sample)
Terminal Equipment		
Supply Air Valve (SAV)	Pending final CDs	- (10% Sample)
General Exhaust Valve (GEV)	Pending final CDs	- (10% Sample)
Hood Exhaust Valve (HEV)	Pending final CDs	- (10% Sample)
Variable Air Volume Box w/ Hot Water (VAV)	Pending final CDs	- (10% Sample)
Unit Heater (UH)	Pending final CDs	- (10% Sample)
Mechanical Infra-Structure		
Ductwork: (Supply, Return, General Exhaust)	All	per Specifications
Hydronic piping: (Chilled Water, Heating Hot Water)	All	per Specifications
Building Automation System (BAS)		
Controls associated with all commissioned systems	Pending final CDs	Specific to BAS hardware and software features

4.2 Electrical

Systems and Equipment	Total Quantity	Sample Rate
Standby Power		
Generator (450kW)	1	1 (100% sample)
Automatic Transfer Switches	2	2 (100% sample)
Lighting and Lighting Control Systems		
Occupancy/vacancy controls	Pending final CDs	Pending final CDs
Interior lighting controls	Pending final CDs	Pending final CDs
Exterior lighting controls	Pending final CDs	Pending final CDs

4.3 Plumbing

Systems and Equipment	Total Quantity	Sample Rate
Domestic hot water system		
Domestic Water Heater (GWH)	3	3 (100% Sample)
Lab Air Compressor System	1	1 (100% Sample)
Lab Vacuum System	1	1 (100% Sample)
DI Water System	1	1 (100% Sample)
Fixtures	Pending final CDs	Pending final CDs
Miscellaneous Plumbing Systems		
Sump Pumps	2	2 (100% Sample)

5 Project Schedule, Tasks and Phasing

The published Owner's project schedule and the updated construction schedules will be used to plan the commissioning activities. The traditional distinction between the design and construction phases is not clearly defined as a result of the design-assist procurement method.

5.1 Owner Project Milestones

The Owner's project milestones dictate the pacing and delivery of the activities for the design team and construction team. This, in turn guides the CxA's activities.

Milestone:	Date:
Design Phase	
Start Design Phase:	Spring 2015
DD	Aug. 2015
CD	Mar. 2016
Final GMP Submittal	-
Construction Phase	
Start of Construction	Apr. 2016
Substantial Completion	Aug. 2017
Owner move-in	-
Occupancy	-

5.2 Design Phase Schedule and Tasks

The Cx activities during the design phase are coordinated with the design schedule.

Tasks:	Date:
OPR/BoD	On-going
Design reviews DD	Nov. 2015
Cx Plan – Summary	Dec. 2015
Design reviews CD	Mar. 2016
Facilities MEP review	To be determined
Cx Specifications	Issued with Project Manual
Final Cx Plan – Construction	Aug. 2016

5.3 Construction Phase Schedule and Tasks

The construction schedule determines the overall sequence of commissioning testing activities and the types of tests that can be conducted. The Cx Plan attempts to coordinate the commissioning activities with the construction schedule. Any significant deviations from the published and approved construction schedule should be communicated to the CxA immediately. The following items are requested to be included in the general contractor's construction schedule.

Tasks:	Date:
Start construction	April 2016
Submittal reviews	On-going
Control sequence submittal review meeting	TBD
Terminal equipment sample inspections	TBD
Building Dried-in	TBD
Mechanical infrastructure tests (clean, flush, pressure tests)	TBD
Terminal equipment mockup	TBD
Primary equipment startups	TBD
Primary equipment IO checkout	TBD
Primary equipment TAB	TBD
Primary equipment PFC (installation, startups and controls work completed)	TBD
Air handler startups	TBD
Air handlers IO checkout	TBD
Air handlers TAB	TBD
Air handlers PFC (installation, startups and controls work completed)	TBD
Terminal equipment startups	TBD
Terminal equipment IO checkout	TBD
Terminal equipment TAB	TBD
Terminal equipment PFC (installation, startups and controls work completed)	TBD
Standby power startup	TBD
Standby power tests	TBD
Lighting controls startups and PFCs	TBD
Lighting controls Cx tests	TBD
Plumbing equipment startups and PFCs	TBD
Plumbing equipment startup	TBD
Plumbing equipment Cx tests	TBD
Substantial completion	Aug. 2017
Warranty period	Sep. 2017 – Aug. 2018

5.4 Construction Phasing

Project phasing will be determined once the construction schedule is issued.

5.5 Testing Phase Schedule and Tasks

The following table identifies the primary testing tasks, in their estimated chronological order. Final dates will be defined for these tests as the construction schedule is defined.

Tasks:	Date:
Cx kickoff meeting	-
Coordinated Drawing reviews: Clash Detection	Summer 2016
Coordinated Drawing reviews: Access for O&M	Summer 2016
Submittal reviews	Summer 2016
Control sequence review meeting	Summer 2016
First-Ofs and field inspections	Fall/Winter 2016
Terminal equipment mockup	Fall/Winter 2016
Lighting controls mockup	Fall/Winter 2016
Primary equipment tests	2017
Air handler tests	2017
Terminal equipment tests	2017
Standby power tests	2017
Lighting controls Cx tests	2017
Plumbing equipment Cx tests	2017
Cx report	After Substantial Completion
Close-out process review (training, documentation)	Fall 2017
Deferred and seasonal tests	Warranty Period
Quarterly reviews	Warranty Period

6 Cx Approach

The purpose of the commissioning process is to ensure that the final, completed project performs in a manner that is consistent with the Owner's expectations. The process relies heavily on the documentation and verification of project performance. A combination of project-specific and standard approaches will be used to accomplish this goal in a cost-effective and efficient manner. The project-specific approaches are identified below: prevention, teamwork, customization and transparency.

6.1 Prevention

Preventive approaches start by identifying a number of critical intermediate performance milestones and the desired outcomes associated with each performance milestone. The actual performance at each milestone is then documented and compared to the desired performance. This approach ensures that potential project deficiencies are identified and resolved as early as possible. This approach avoids re-work, change-orders, and associated scheduling issues, as well as preventing project compromises. Standard milestones at which preventive approaches are used include the following.

6.1.1 Design Reviews

The design review process allows Cx concerns to be addressed prior to the release of construction documents.

6.1.2 Submittals Reviews

Submittal review comments are used to confirm product specific features prior to equipment orders.

6.1.3 Equipment Inspections

Field inspections of actual equipment prior to installation are used to confirm that submittals and virtual design and construction practices are properly coordinated.

6.1.4 Construction Means and methods

On-site inspections of the first installation of infra-structure and equipment covered in the Cx scope allows any issues regarding construction means and methods to be resolved as early as possible.

6.1.5 Mockups

Mockups of sub-systems (typically, terminal equipment, lighting controls) allow all project stakeholders to verify the performance of those items that are installed in large quantities. A mockup of a single unit early in the construction phase of a project can confirm compliance of these systems with project requirements, and frequently identifies issues that could have resulted in re-work, schedule delays, or a compromise in project performance.

6.1.6 Installation and Startup Checklists

The contractors are expected to use checklists as a means of internal Quality Assurance (QA). The use of checklists tends to minimize the number of non-conforming installations that are encountered during subsequent construction tasks such as startups, point-to-point checks, functional performance tests, and punch-lists.

6.1.7 Controls Review

A review of the sequences of operation (SOO) and Functional Performance Tests (FPTs) with the controls contractor is used to identify the final performance requirements of the project. This review establishes a consensus on the details of the SOO before the controls contractor implements the SOO.

6.2 Teamwork

Throughout the project, the CxA's role is one that can easily conflict with those of the design team and the contractor. Our approach to Cx is to create a collaborative atmosphere by focusing on the success of the project overall. By making the Cx effort a collaboration with the design team, construction team, and the building operator, all stakeholders benefit from the results of the Cx process. The design team will end up with fewer change orders while receiving additional assurance that the designs will end up constructed and operated as intended. The contractor will end up with additional confidence that installations will function correctly and be accepted by the owner, thereby reducing re-work and call-backs. The operators will gain knowledge about the operation of the project throughout the design and construction phases. This informal training will greatly improve their understanding of the project's design intent and increase their confidence in the systems and equipment.

6.3 Customization

The Cx process and test protocols are tailored to the specific requirements of the owner, operator and the equipment itself. The following items identify several customized approaches to the Cx process that we anticipate for this project.

6.3.1 Control Sequences

The Building Automation System (BAS, or controls) for this project plays a key role in both the functionality of the project as well as the operation of the project. Reviews of the final controls submittal with stakeholders from the design team, construction team and operators will flush out any deficiencies or requirements that have not been met.

6.3.2 Lab Spaces Envelope

A critical factor in the design of the lab floors is the creation of a lab suite that is properly pressurized with respect to the non-laboratory spaces. This pressure relationship satisfies mechanical code requirements as well as scientific needs. A large number of sealed penetrations of the lab suite envelope are likely to occur, such as ductwork, piping for heating and cooling systems, lab gases, low voltage infra-structure. The Cx Plan will develop a testing procedure that results in a reasonable level of certainty that the integrity of the lab suite enclosure is maintained. The exact testing protocol will depend to a large extent on the actual construction sequence. The testing protocol will likely include the use of smoke pens to demonstrate proper pressurization.

6.3.3 Building Automation System

A temporary, stand-alone network has been included in the project manual to facilitate timely completion of the installation, programming and user interface of the BAS. This approach will avoid the scenario where all of the controls work occurs at the same time, at the very end of the project, as occupants are moving into the building.

The use of an integrated HVAC and lighting control system will require a sequential, iterative testing process to ensure individual components are vetted prior to testing the systems at a larger scale.

6.3.4 Primary Heating and Cooling Plants

Custom test protocols will be developed to ensure equipment components as well as entire assemblies function correctly. The plants will be tested at design conditions as well as no-load and low-load conditions.

6.3.5 Terminal Unit Mockup

A mockup of typical terminal unit installations is recommended. This mockup will allow a performance check of many design and construction factors before the remaining units are completed, including controls integration with mechanical and electrical systems, occupant and operator interfaces, and configuration of the graphical user interface (GUI).

6.3.6 Standby Power

The generator can be load tested as soon as it has been installed and the electrical contractor has completed startups. Cx of the final standby power system will include a full power-loss test, prior to occupant move-in.

6.4 Transparency

The Cx process touches thousands of pieces of equipment, involves dozens of stakeholders and occurs throughout the entire timeline of the project, from early design through the warranty period. Many of the tests and issues are multi-disciplinary and complex, requiring detailed knowledge of both design and construction. As a result, it is very easy for the message to get lost. Our communications with all project stakeholders are designed to be simple, clear and concise. We take a four-pronged approach to our communications.

6.4.1 Clear Expectations

First we ensure that expectations of all stakeholders are clearly defined up front using the summary Cx Plan, Preliminary Cx Plan and Final Cx Plans. Test protocols are distributed ahead of time.

6.4.2 Frequent Communications

Second, we communicate intermediate results on an on-going basis using our Cx Progress Reports (CxPR).

6.4.3 Results Oriented

Third, our CxPRs are typically limited to a single page that clearly spells out what was tested, how it was tested, what we observed, and what needs to be fixed or addressed. A typical CxPR has four sections.

1. Objective

2. Methodology
3. Observations
4. Recommendations

In less than a minute, all stakeholders can determine the general compliance of the test results with the project's requirements, as well as any action items required. To further simplify the distribution of this information, the transmittal will identify the presence or absence of any show-stoppers contained in the CxPR.

6.4.4 Cx Task Tracking

Fourth, the all the intermediate Cx process results are tracked in the Cx Tasks Status Report. A single page captures the percent complete of all major construction and testing tasks for all equipment in the scope.

While LEED requires a final Cx Report at the completion of the project, we deliver intermediate reports with the goal of keeping all stakeholders informed before the project is deemed substantially complete. A typical final Cx report is easily two hundred pages long. By keeping all stakeholders informed on a regular basis, including the tracking of individual tasks, the final report ends up being a confirmation of what has already been shared, rather than a big surprise at the end of the project.

7 Design Phase Tasks

7.1 Define Owner Project Requirements (OPR)

The CxA shall lead the OPR process and provide feedback on the OPR development tasks that are delegated to the various Owner stakeholder representatives. The CxA shall assist in the development of the OPR where necessary. Final OPR materials shall be collated by the CxA and distributed for review.

7.2 Assist Development of Basis of Design (BoD)

The CxA shall review the BoD and provide feedback. The BoD shall be reviewed for compliance with the OPR. A copy of the BoD shall be included in the Cx Report.

7.3 Preliminary Cx Specifications

Preliminary Cx specifications shall be issued in the original bid documents to reflect the extent of the contractor's involvement with the commissioning process.

7.4 Schematic Design Review

The schematic design (SD) review shall be conducted to review fundamental design concepts and to inform the CxA on the general requirements of the project.

7.5 Preliminary Cx Plan

A Preliminary Cx Plan shall be developed for the design phase that defines the tasks, scope and process for commissioning of the project.

7.6 Final Cx Specifications

Final Cx specifications shall be issued together with the specification sections relevant to the Cx process. Recommended changes to specifications developed by the design team shall be issued upon a review of the specifications relevant to the Cx process. Cx specifications are provided in the bid documents to accurately reflect the contractor's involvement with the commissioning process.

7.7 Preliminary Cx Plan

A Preliminary Cx Plan shall be developed for the design phase that defines the tasks, scope and process for commissioning of the project.

7.8 Design Progress Reviews

A number of intermediate progress review meetings are anticipated. The CxA shall participate in a select number of these review meetings.

7.9 Construction Documents Review

The construction documents (CDs) shall be reviewed and back-checked at 100% completion. Review comments shall be issued in sufficient time to allow design team to respond to review comments. CDs shall be back-checked at subsequent CD issuance.

8 Construction Phase Tasks

8.1 Cx Kick-Off Meeting

A Cx kick-off meeting (KOM) shall be used to introduce the Cx team and highlight the Cx process. Any trade involved in the Cx scope should be present for this meeting. The CxA will provide a meeting agenda and issue meeting minutes.

8.2 Submittal Review

The CxA shall review equipment submittals for compliance with Cx requirements (operability, maintenance, and accessibility) as well as for integration and cross-disciplinary coordination. Equipment submittals shall include Installation, Operation & Maintenance (IOM) requirements, start-up procedures, and control diagrams. The Cx process requires that inter-related submittals may need to be reviewed concurrently. Submittal review comments will be issued and tracked in the Cx issues Log. The Control Contractor's submittal will be subject to a very detailed review and will require several weeks to complete. Specific submittal requirements for the Controls Contractor may be defined in the Cx specifications.

8.3 Close-out Documents and Training Requirements

The CxA shall discuss close-out document and training requirements with the Owner's representatives. The close-out documents' requirements will be defined and shared with the Cx Team. The training requirements will require input regarding the depth and content covered for each type of equipment. The training requirements will enable the contractor to develop a final training plan.

8.4 Final Cx Plan

A Cx Plan is developed during the construction phase that defines the tasks, scope and process for commissioning of the project. The plan will be issued for owner review and approval.

8.5 Field Observations

Field Observations shall inspect and document on-going construction activities. Field Observations will be reported in Cx Progress Reports, with any Cx issues tracked independently in the Cx Issues Log. Monthly Field Observations are anticipated starting in January of 2014.

8.6 Installation and Startup Checklists

The CxA shall approve checklists that will be used by the contractor to document and verify installation and startup activities. The CxA will provide standard checklists for terminal equipment if the contractor's internal QA/QC forms do not provide sufficient detail for typical field quality control. Installation checks are static in nature and review the physically installed component, not the operation of those components. Startup checks (eg: motor current readings and other operational characteristics) are completed by the contractor and serve as a field quality control measure to confirm the startup is complete. The installation and startup checklists shall be signed off by the Contractor and forwarded to the CxA for review. Select equipment startups may be observed by the CxA for confirmation and verification purposes.

8.7 Controls Checklists

The controls contractor shall provide Input/Output (I/O) checklists (also known as point-to-point checklists) that document their field quality control procedures. The checklists should indicate that each control point has been tested successfully through its full range, and testing shall be verified and documented.

8.8 Test, Adjust and Balance (TAB) Verification

The TAB contractor shall complete TAB procedures per specifications. The CxA shall witness select TAB activities to independently verify field data presented in the TAB report.

9 Testing Phase Tasks

9.1 Installation Means and Methods Review

The CxA will perform an on-site review of the first installation of any given type, for equipment and systems relevant and applicable to the Cx scope of work. The equipment and systems will be reviewed for compliance with the specifications, drawings, details, and manufacturer's installation requirements. This approach minimizes deficiencies for duplicated installations and serves as a model for field personnel throughout construction. Typical equipment and systems targeted for a Means and methods review include the following items.

- Mechanical and Plumbing infra-structure (pipe, duct, hangers, sealing, testing, insulation, labeling)
- Equipment and equipment trim kits (air-side and hydronic specialties, dampers and valves, insulation, labeling)
- Controls infra-structure and installations

The owner's operating staff is encouraged to attend and participate in this review.

9.2 Accessibility Review

As construction progresses, each piece of equipment will be inspected and reviewed with an Owner's representative for accessibility. Any noted deficiencies will be documented in the Issues Log.

9.3 Mockup Tests

In projects where construction elements are repeated in large numbers, mockups are utilized early in the project schedule to allow all stakeholders (Owner, Contractor, Designer) an opportunity to coordinate intent and performance expectations with actual field construction details. Construction elements suitable for mockups can be limited to a specific model of equipment that is installed in multiple locations. Or, a mockup can be as broad in scope as an entire floor of a multi-story building.

To assess the mockup performance, all control system end devices will need to be installed and functional, even if the controlled equipment itself is not yet operational. This level of completion will allow point-to-point testing of the control system, as well as a rudimentary checkout of control sequences, control and monitoring functions (e.g. alarms, trend-logs) and user interface details. The owner's operating staff is strongly encouraged to attend and participate in this review.

9.4 Controls Input/Output Verification

The CxA shall witness a sample of I/O checkouts by commanding outputs through their signal range while observing proper response in the field. Sensor and safety device locations are reviewed against the approved control submittal and the user interface equipment diagram, providing confirmation that sensor and device placement or installation will result in correct system performance and user interface data is accurate.

9.5 Pre-Functional Checks (PFC)

After the installing contractor sends completed installation and start-up forms to the CxA, the CxA shall independently review a sample of equipment installations to verify the accuracy of checklists completed by the contractor. The installation will also be reviewed for compliance with the specifications, drawings, details, and manufacturer's installation requirements. This is a static review of the installed equipment, including accessories and controls, and does not include a review of dynamic or active performance.

9.6 Functional Performance Tests (FPTs)

The FPTs provide a framework within which the individual equipment and sub-systems are tested successively and incrementally to ensure that final system-level tests will be successful. FPT protocols will be developed by the CxA based on the approved controls submittal and current design documents, including any change orders and formal design revisions. Clarifications from the contractors and design team may be required to develop the testing procedures. Once developed, the test scripts will be sent to the owner, design team, and contractors for review.

Equipment and system FPTs start with basic tests of essential equipment functions. The tests gradually increase in complexity from individual components such as dampers, fans, and pumps to completed equipment assemblies such as air handling units and chilled water plants. Final system tests document the overall project's ability to achieve desired performance throughout a range of operating conditions.

Note that the use of the terms “startup test” and “functional test” is fluid and often inter-changeable. A startup test of an air handler can require functional tests of the individual components of the air handler, such as the Variable Frequency Drive. In that case, functional tests can actually precede higher-level startups. In this fashion, FPTs are conducted at increasingly higher (or, more complex) levels. The higher-level FPTs are typically referred to as “system tests”. System tests include building space pressure control tests, occupied/unoccupied transition tests, seasonal tests, and power failure tests, for example.

9.6.1 Equipment FPTs

FPTs shall be scheduled with the construction team following confirmation that the equipment and systems to be tested have been properly installed and started, monitoring and control sequences are functional, and third-party testing is complete. FPTs shall be carried out under the direction of the CxA and with the assistance of the associated contractors. The systems can be tested under simulated load conditions and operating modes, or under real-world conditions.

9.6.2 Controls System FPT

The functionality of the GUI will be evaluated separately, and during equipment FPTs. The graphical user interface review shall be carried out under the direction of the CxA and with the assistance of the associated contractors.

9.6.3 System Tests

CxA shall develop System Test protocols based on the facility use. System Tests shall be carried out under the direction of the CxA and with the assistance of the controls contractor and the Owner’s representatives (Operator, Occupant). System Tests are geared towards global system performance measures, including optimal control routines such as optimal start and duct static pressure reset routines. System test definitions will be based on the final control sequences and system-level performance measures provided in the construction documents.

9.7 Deferred and Seasonal Tests

Deferred and Seasonal Tests shall be carried out under the direction of the CxA and with the assistance of the Contractor, Design Team and the Owner’s representatives (Owner, Operator). Deferred testing will occur when components and/or assemblies are not ready for FPTs (e.g. missing control hardware or delayed equipment deliveries prevents final testing). Depending on the project schedule, seasonal testing may be required to test the system under varying loads. Seasonal testing reviews space transitions and system performance during low, increasing, and design loads in the winter and summer months.

9.8 Final Cx Report

CxA shall document the Cx process results in a Final Cx Report. The Final Cx Report shall include project information contained in the Final Cx Plan in addition to Cx process results (Meeting Minutes, Issues Logs, and Progress Reports); Cx products (equipment reports, field observations, checklists, and test forms and results) and project documentation (floor plans, single-line riser diagrams).

10 Operation & Occupancy Phase Tasks

10.1 Training

CxA shall review the final equipment training plan and may witness or supplement selected training sessions. A final training session on integrated systems and design intent shall be presented by the CxA with the assistance of the Controls Contractor and Design Engineers.

10.2 Warranty Management

CxA shall verify existence of a warranty management plan, including tracking of warranty items by means of a warranty log. The warranty log allows monitoring of deficiencies uncovered as systems are operated under real-world conditions.

10.3 Close-out Document Review

CxA shall review the planned approach for managing the creation, format and distribution of operation and maintenance manuals, project as-built and record drawings, and warranty management. Close-out documents shall be reviewed for accuracy and completeness.

10.3.1 O&Ms

CxA shall verify O&M submittals are submitted and meet specified criteria.

10.3.2 As-built and Record Drawings

CxA shall review and spot-check quality of drawings.

10.4 Attic Stock

CxA shall review the attic stock transfer plan and confirm receipt of attic stock by Owner's representatives.

10.5 LEED System Manual

LEED requirements include the development of a System Manual. The bulk of the System Manual's contents shall be developed by the Contractor and Engineer of Record and shall be assembled by the CxA. The content and format of specific items in the manual, such as integrated system design and operation shall be coordinated with the Operator.

10.6 Cx Report Addenda

The Final Cx Report may be updated electronically during the Operation and Occupancy Phase. Such updates may be based on by means of addenda that can be based on Cx Progress Reports or other work products.

10.7 LEED Cx Submittals

The CxA shall compile and upload the information required to support the LEED submittals. Final LEED submittals will require sign-off by the Owner's representative.

10.8 Quarterly Reviews

The quarterly reviews address outstanding items from the Issues Log, solicit feedback from operations staff and occupants on overall project performance.

10.9 Close-out Meeting

A close-out meeting shall be attended or conducted by the CxA. CxA shall review system performance and operation with Owner's representative prior to expiration of the warranty phase. A ten-month review is conducted after seasonal testing and deferred testing have been completed. The ten-month review addresses outstanding items from the Issues Log, solicits feedback from operations staff and occupants on overall project performance, and can serve as a lessons-learned session for the Owner.

11 Management and Reporting

The Cx process utilizes multiple management tools to facilitate coordination of Cx tasks with the other members of the Cx team.

11.1 Cx Meetings

11.1.1 Design Review meetings

Design review meetings shall be used to coordinate Cx activities with the design team's efforts throughout the design phase. At least one meeting will be attended to become familiar with the project's scope, schedule, budget, and design intent.

11.1.2 Owner and Contractor Cx Kick-Off Meetings

The Cx process is started with the Cx kick-off meeting (KOM). During the KOM the Cx process is reviewed with the contractors, including contact information, communication and management protocols, and tasks and responsibilities during the Cx process.

11.1.3 Project Cx meetings

Meetings will be coordinated with construction meetings to facilitate planning of Cx tasks. Contractors with work affected by the Cx process are expected to attend these meetings. Anticipated quantity: six (6).

11.1.4 Controls Meeting

Eight additional meetings will be coordinated with the BAS Controls Contractor to review design intent, implementation, and test scripts. Anticipated quantity: two (2).

11.1.5 Construction Meetings

A limited number of Owner, Architect, Contractor construction meetings (OAC meetings) will be attended. A brief Cx progress update shall be provided at those meetings. A Cx representative will attend one project construction meeting per month. Anticipated quantity: eighteen (18).

11.1.6 LEED Meetings

Six additional LEED meetings, led by the LEED consultant, will be used to coordinate Cx efforts and the OPR development in particular with the Cx Team members. Anticipated quantity: four (4).

11.2 Communications

Owner, Contractor and Design Team representatives shall copy CxA on all communications relevant to Cx scope of work, including the following items.

- Design Changes
- Construction document updates or changes (including ASIs and ESIs)
- Requests for Information (RFIs)
- Schedules
- Meeting notifications and Minutes, including MEP coordination and startup meetings
- Submittals
- Field tests and startups
- Startup Reports
- Field Tests Reports
- Field Observation Reports
- Quality Assurance and Quality Control items
- Third party inspections, including local and state AHJ and private consultants
- Punch-lists
- Training
- O&Ms
- Record documents
- Warranty issues
- LEED certification process

11.3 Checklist Completion

Logistical management of checklists is addressed in the Cx Sub-contractor meetings. The Cx testing process is outlined here:

- CxA and Contractor agree on Installation and Startup checklists for selected equipment.
- Contractors complete installation and startup checklists.
- The contractor shall submit all completed checklists to the CxA.
- FPTs are reviewed by Cx Team.
- FPT protocols are discussed in detail with Contractor responsible for execution of FPT. This is typically the Controls Contractor. Up-front review of FPT requirements is conducted to confirm ability to perform tasks such as point manipulations and overrides, and collect data via trend logs and run-time logs.

11.4 Issues Log

CxA shall maintain and distribute an Issues Log throughout the Operation phase to track items that can compromise the project's performance. The Issues Log shall track status, date observed, details regarding the issue, proposed resolution, and entity responsible for resolving the issue. Updates shall be issued on a regular, timely basis.

11.5 Cx Tasks Status Report

CxA shall maintain and distribute a report indicating outstanding Cx Tasks to be completed throughout the construction and testing phases. Updates shall be issued on a regular, timely basis.

11.6 Cx Progress Reports

Commissioning Progress Reports will be issued to the Cx Team providing a brief narrative of on-site activities and upcoming work. The current Cx Project Status and Issues Log are attached to the Cx Progress Reports to provide updates to the owner.

11.7 Final Cx Report

The Final Cx Report will be issued to the owner. This report can be issued once the testing phase is complete or during the Operation and Occupancy Phase.

11.8 System Manual

The Final Cx Report will be issued directly to the owner. This report is developed by the CxA once the testing phase is complete or during the Operation and Occupancy Phase. Any report addenda will be issued electronically.

12 Attachments

Not all items are included in every Cx Plan release. As the Cx effort progresses, additional items shall be included.

12.1 Summary Cx Plan [page 1]

12.2 Installation and Start-up Checklist [page 2]

Sample item developed by CxA included.

12.3 Input/Output Checklist [page 16]

Sample item provided by controls contractor on previous project.

12.4 Prefunctional Checklist [page 19]

Sample item developed by CxA included.

12.5 Input/Output Verification [page 24]

Sample item developed by CxA included.

12.6 Functional Performance Tests [page 34]

Sample item developed by CxA included.

12.7 System Tests [page 45]

Sample item developed by CxA included.

12.8 Cx Progress Reports [page 52]

Sample item developed by CxA included.

12.9 Issues Log [page 55]

Sample item developed by CxA included.

12.10 Cx Task Status Report [page 56]

Sample item developed by CxA included.

12.11 Cx Kick-Off Meeting Agenda [page 57]

Sample item developed by CxA included.

Cx Plan - Summary

Project:	Webster Univ: ISB
Job #:	1136-16
Scope:	Cx, Fund & Enh

Cx Team Member:	CxA	Owner	Design Team	Contractors	Issues Log	Mtgs & CPR & Reports		
Phase, Task:								
Design								
OPR	Direct	Approve	Review	-	Project meetings and Cx			
BOD	Review	Approve	Submit	-				
Utility Incentives	Review	-	-	-				
Training Requirements	Direct	Participate	Submit	-				
SD docs	Review	Approve	Submit	-				
DD docs	Review	Approve	Submit	-				
CD	Review	Approve	Submit	-				
Cx Specs	Submit	-	-	-				
Cx Plan - Prelim	Submit	-	-	-				
Construction Phase Tasks								
Submittals	Review	-	Approve	Submit				
Cx Kick-off Meeting	Direct	Participate	Participate	Participate				
Close-Out Plan	Review	Review	Review	Submit				
Cx Plan - Final	Submit	Review	Review	Review				
Field Observations	Direct	Participate	Participate	Participate				
First-Of Review	Direct	Participate	Participate	Participate				
Mockup Review	Direct	Participate	Participate	Participate				
Control Seq. Review Mtg.	Conduct	Participate	Participate	Participate				
Installation Checklists	Review	-	-	Submit				
Startup Checklists	Review	-	-	Submit				
Controls Startup	Review	-	-	Submit				
TAB Plan	Review	-	Review	Submit				
TAB Report (prelim)	Review	-	Review	Submit				
Testing Phase Tasks								
PFC	Review	Review	Review	Submit	Issues Log Updates	Project meetings and Cx Progress Reports		
FPT	Direct	Participate	Participate	Participate				
System Tests	Direct	Participate	Participate	Participate				
Deferred testing	Direct	Participate	Participate	Participate				
Seasonal Testing	Direct	Participate	Participate	Participate				
Cx Report	Submit	Review	Review	Review				
Operation & Occupancy Phase Tasks								
Training	Review	Participate	-	Direct				
Integrated Training	Direct	Participate	Participate	Participate				
Warranty Log	Review	Participate	Participate	Participate				
O&M Manuals	Review	Review	Review	Submit				
As-Builts	Review	Review	Review	Submit				
Record Drawings	Review	Review	Submit	-				
System Manual	Submit	Review	-	-				
LEED Submittals	Submit	Review	-	-				
Quarterly Perf. Reviews	Direct	Participate	Participate	Participate				
Cx Report - Addenda	Submit	Review	-	-				
Close-out Meeting	Participate	Participate	Participate	Participate				
Cx Process Management Tasks								
Cx Meetings	Direct	Participate	Participate	Participate				
Issues Logs	Submit	Participate	Participate	Participate				
Cx Progress Reports	Submit	Review	Review	Review				

Installation: Div.22 - Dom. Water Heater

Job:	VA, Danville
Proj. #:	1724-01

General Notes:

All items complete unless noted	
Project Manager's Name (Printed):	
Project Manager's Signature:	

Instructions:

Provide "✓" for all successful checks.

Use keyed notes at bottom for failed checks.

Initials:		
Start Date:	/ /	/ /
Start Time:	:	:
End Date:	/ /	/ /
End Time:	:	:

Installation Checklist

A. Application Data

Equipment ID:	WH-1	WH-2
Load / Area Served:	Building	Building
Installed Location:	Mech 001	Mech 001
Sheet Number:	P101	P101

B. Model Data

1-Manufacturer	Submitted Data	State Water Heaters	State Water Heaters
	Actual		
2-Model Number	Submitted Data	SUF 60	SUF 60
	Actual		
3-Serial Number	Actual		
4-Type of Gas	Submitted Data	Natural or Propane	Natural or Propane
	Actual		
5-Input (BTUH)	Submitted Data	120,000	120,000
	Actual		
6-Thermal Efficiency	Submitted Data	95%	95%
	Actual		
7-Capacity at 30F temperature rise (GPH)	Submitted Data	461	461
	Actual		

Installation: Div.22 - Dom. Water Heater

Equipment ID:	WH-1	WH-2
Load / Area Served:	Building	Building
Installed Location:	Mech 001	Mech 001

C. Installation Checks

Unit is free of visible damage.		
Permanent nameplate affixed to unit.		
Unit is accessible for routine maintenance.		
Unit is anchored to resist movement.		
Unit has been tested for leaks.		
Water heater inspection complete by responsible party.		

Piping

Piping connections complete and supported independently of unit allowing for maintenance.		
Dirt leg capped and accesible for maintenance purposes.		
Hydronic piping has been tested for leaks.		
No apparent leaks.		
All valves and strainers installed in the correct flow direction.		
Pressure relief and drain lines piped to nearby floor drain.		

Controls

High temperature limit switch installed.		
Control wiring complete.		
Thermostat set to 140F.		

Electrical

All wiring is protected and terminated.		
Conduit is supported.		
Electrical disconnect installed and labeled near unit.		

Startup

OEM startup complete.		
Pressure tests complete.		
Cleaning & flushing complete.		

Installation: Div.22 - Dom. Water Heater

Equipment ID:	WH-1	WH-2
Load / Area Served:	Building	Building
Installed Location:	Mech 001	Mech 001

Installation Keyed Notes

#	Description	Issue #	Status
1			
2			
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Installation: Div.23 - DOAS Unit

Job:	
Proj.#:	

General Notes:

All items complete unless noted Project Manager's Name (Printed):	
Project Manager's Signature:	

Instructions:

Provide "✓" for all successful checks.

Use keyed notes at bottom for failed checks.

Initials:				
Start Date:	/ /	/ /	/ /	/ /
Start Time:	:	:	:	:
End Date:	/ /	/ /	/ /	/ /
End Time:	:	:	:	:

Installation Checklist

A. Application Data

Equipment ID:	DOAS-1	DOAS-1		
Building #	130	131		
Area Served:	ALL	ALL		
Location:	130	131		

B. Model Data

1-Manufacturer	Submitted Data	DESERT AIRE	DESERT AIRE		
	Actual				
2-Model Number	Submitted Data	QS08D	QS08D		
	Actual				
3-Serial Number	Actual				

C. Install Checks

General Installation

Unit is free of visible damage				
Permanent nameplate affixed to unit				
Unit is accessible for routine maintenance				
Unit does not block access to existing equipment				
Access doors open opposite of static pressure or provided w/ safety latches				
Access doors can be fully opened and closed.				

Installation: Div.23 - DOAS Unit

Equipment ID:	DOAS-1	DOAS-1		
Building #	130	131		
Area Served:	ALL	ALL		
Location:	130	131		
Doors and penetrations in unit are sealed				
Filters installed				
Permanent electrical service is available				
Unit is installed level.				
Unit is securely anchored / mounted.				

Ductwork

SA filter MERV rating	Submitted Data	8	8		
	Actual				
RA filter MERV rating	Submitted Data	8	8		
	Actual				

Controls

Temperature sensors located where indicated on construction drawings.				
Control wiring complete				

Electrical

Conduit is supported				
Power disconnects labeled and installed				
Grounding installed for unit and unit components				
Wiring is protected				

Heat Recovery Wheel

Wheel is free of visible damage				
Rotor is sealed around the rotor wheel				

Installation: Div.23 - DOAS Unit

Equipment ID:	DOAS-1	DOAS-1		
Building #	130	131		
Area Served:	ALL	ALL		
Location:	130	131		

Cooling Coil

Piping is supported independently at coil				
Piping system flushed, cleaned, and pressure tested				
Coil has been tested for leaks				
Coil is clean with no damage to fins				
Access provided to coil				
Refrigerant suction lines insulated				
P-Trap installed with proper dimensions. Record height difference between trap inlet and outlet.				
Record height difference between trap outlet and bottom of trap.				
Condensate line maintains a minimum horizontal slope of not less than 1/8" per linear foot				
Condensate drain functions and is indirectly connected to drain				
Condensate drain functions at full speed of fan				
Identify auxiliary condensate protection method(s) provided: 1 Auxiliary drain pan with minimum 15" depth and 3" larger than unit or coil dimensions in width and length. Pan installed level. 2 An overflow drain line connected to drain pan at higher level than primary line. 3 Auxiliary drain pan provided with water detection device in lieu of separate drain line. Pan installed level. 4 Water detection devices installed to shut off equipment.				

Installation: Div.23 - DOAS Unit

Equipment ID:	DOAS-1	DOAS-1		
Building #	130	131		
Area Served:	ALL	ALL		
Location:	130	131		

Hot Gas Reheat Coil

Piping is supported independently at coil				
Piping system flushed, cleaned, and pressure tested				
Coil has been tested for leaks				
Coil is clean with no damage to fins				
Access provided to coil				
All valves and installed in the correct flow direction				
Pipes insulated and labeled				
Isolation valves, P/T plugs installed				
Manual valves fully open and close				

Reheat Coil (Hot Gas Bypass)

Piping is supported independently at coil				
Piping system flushed, cleaned, and pressure tested				
Coil has been tested for leaks				
Coil is clean with no damage to fins				
Access provided to coil				
Pipes insulated and labeled				

Auxiliary Gas Fired Reheat Coil

Piping is supported independently at coil				
Piping system flushed, cleaned, and pressure tested				
Coil connections have been tested for leaks				
Burner is clean with no damage.				
Access provided to coil and gas train				
All valves and installed in the correct flow direction				
Pipes insulated and labeled				

Installation: Div.23 - DOAS Unit

Equipment ID:	DOAS-1	DOAS-1		
Building #	130	131		
Area Served:	ALL	ALL		
Location:	130	131		
Isolation valves installed				

SAMPLE

Installation: Div.23 - DOAS Unit

Equipment ID:	DOAS-1	DOAS-1		
Building #	130	131		
Area Served:	ALL	ALL		
Location:	130	131		
Manual valves fully open and close				

Supply Fan

Motor Volts / Phases	Submitted Data	208/3	208/3		
	Actual				
Motor RPM / HP	Submitted Data	3	3		
	Actual				
Correct Belt Tension/Alignment					
Vibration Isolation Installed					
Belt Size / Qty					
VFD installed					

Exhaust Fan

Motor Volts / Phases	Submitted Data	208/3	208/3		
	Actual				
Motor RPM / HP	Submitted Data	- / 1	- / 1		
	Actual				
Correct Belt Tension/Alignment					
Vibration Isolation Installed					
Belt Size / Qty					
No unusual noise or vibration during operation					
VFD installed					

Installation: Div.23 - DOAS Unit

Equipment ID:	DOAS-1	DOAS-1		
Building #	130	131		
Area Served:	ALL	ALL		
Location:	130	131		

Installation Keyed Notes

#	Description	Issue #
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Installation: Exhaust Supply Fans

Job:	
Proj. #:	

General Notes:

All items complete unless noted Project Manager's Name (Printed):	
Project Manager's Signature:	

Instructions:

Provide "✓" for all successful checks.

Use keyed notes at bottom for failed checks.

Initials:							
Start Date:	/ /	/ /	/ /	/ /	/ /	/ /	/ /
Start Time:	:	:	:	:	:	:	:
End Date:	/ /	/ /	/ /	/ /	/ /	/ /	/ /
End Time:	:	:	:	:	:	:	:

Installation Checklist

A. Application Data

Equipment ID:	EF-1	EF-2	EF-3	SF-1			
Building #	130	130	130	130			
Area Served:	Kitchen Hood	Oxygen Storage	Kitchen General	Condenser Room			
Location:	Roof	Oxygen Storage	Roof	Condenser Room Wall			

B. Model Data

1-Manufacturer	Submitted Data	CAPTIVEAIRE	COOK	COOK	COOK			
	Actual							
2-Model Number	Submitted Data	NCA8FA	GC-144	100C2B	36XLWHS			
	Actual							
3-Serial Number	Actual							

C. Design Requirements

3 - Fan Motor Volts / Phases / Amps	Submitted Data	115/1/4.6	115/1/0.7	115/1/0.7	208/3/19			
	Actual							
4 - Fan Belt Size / Qty	Actual		NA					

D. Install Checks

General Installation

Unit is free of visible damage							
Permanent nameplate affixed to unit							
Unit is accessible for routine maintenance							
Unit does not block access to existing equipment							
Permanent electrical service is available							
Unit is installed level.							
Unit is securely anchored / mounted.							

Installation: Exhaust Supply Fans

Building #	130	130	130	130			
Area Served:	Kitchen Hood	Oxygen Storage	Kitchen General	Condenser Room			
Location:	Roof	Oxygen Storage	Roof	Condenser Room Wall			

Ductwork

Ductwork connected and clean							
Ductwork seams sealed							

Controls

Control wiring complete							
-------------------------	--	--	--	--	--	--	--

Electrical

Conduit is supported							
Power disconnects labeled and installed							
Grounding installed for unit and unit components							
All wiring is protected and terminated.							

Vibration Isolation Installed							
-------------------------------	--	--	--	--	--	--	--

Installation Keyed Notes

#	Description	Issue #	Status
1			
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10			

Installation: Div.26 - Int.Lighting

Job:	
Proj. #:	

Contractor Sign-off

Project Manager's Name (Printed):	
Project Manager's Signature:	
Date:	

Instructions:

Provide "✓" for all successful checks.

Use keyed notes at bottom for failed checks.

Initials:					
Start Date:	/ /	/ /	/ /	/ /	/ /
Start Time:	:	:	:	:	:
End Date:	/ /	/ /	/ /	/ /	/ /
End Time:	:	:	:	:	:

Installation Checklist

A. Application Data

Room #					
Type of fixture(s)					
Type of switch(es)					
Type of occupancy sensor (If applicable)					

B. Install Checks

General Installation

Light fixtures are located per plans					
Light switches are located per plans					
Light switch controls the fixtures indicated on the design drawings					
Light fixtures are properly supported					
Correct lamp type installed in each fixture					
Low voltage wiring correctly, color coded, installed, terminated, and marked.					
Exit sign chevron arrows pointing in correct direction.					
Correct type of occupancy sensor installed in appropriate location					
Occupancy sensor wiring correctly installed, terminated and marked.					
Low voltage wiring correctly, color coded, installed, terminated, and marked.					

Lighting Controls

Lighting control is installed per manufacturers recommendations					
Occupancy sensors installed in direction suggested by manufacturer					
Occupancy sensor's sensitivity adjusted to meet the room requirements.					
Occupancy sensors "Off delay" set per recommendation.					
Occupancy sensor turns the lights on when entering the room.					
Occupancy sensor turns the lights off after leaving the room.					
Light switches properly labelled					
Luminaires meet specified levels					
Luminaires dim down to specified levels					

Installation: Div.26 - Int.Lighting

Room #					
Type of fixture(s)					
Type of switch(es)					
Type of occupancy sensor (If applicable)					

Installation Keyed Notes		Issue #	Status
#	Description		
1			
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3. POINT-TO-POINT CHECKOUT

Notes:

- AHU isolation dampers are controlled directly by VFD, not thru BMS
- Return Air temperature and humidity sensors, return air damper and mixed air low static switch will be verified after Return Air is opened to AHUs
- Filter differential pressure switches are Owner provided but have not been furnished

SMR-AHU-1 (FAC 2611) Controller - Field Checkout

AHU-1

NAE#: 27
 MS/TP TRUNK: 2
 MS/TP ADDR: 7
 Zigbee PAN ID:

SA Bus Devices

IOM 2721/5		
IOM 4710/4		

CHECKOUT INFORMATION:

Hardware Point	Point/Object Name	Field Device Type	CHK	Field Value	Controller Value	AI# Offset	Note #
UI IN-1	Discharge Air Static Pressure 1 / DA-P	DP	✓	2.00"			
UI IN-2							
UI IN-3	Discharge Air Temperature / DA-T	Sensor	✓	55.0			
UI IN-4	Mixed Air Temperature / MA-T	Sensor	✓	72.5			
UI IN-5	Preheat Temperature / PH-T	Sensor	✓	73.0			
UI IN-6	Heat Coil Pump 1 Status / HCP1-S	CT-Relay	✓	OFF			
Hardware Point	Point/Object Name	Field Device Type	CHK	Action (NO/NC)	State 0	State 1	Note #
BI IN-7	Supply Fan 1 Status / SF1-S	CT Relay	✓	N/O	OFF	ON	
BI IN-8	Supply Fan 2 Status / SF2-S	CT Relay	✓	N/O	OFF	ON	
Hardware Point	Point/Object Name	Field Device Type	CHK	Action (NO/NC)	State 0	State 1	Note #
BO OUT-1	Supply Fan 1 Command / SF1-C	Relay / VFD	✓	N/O	OFF	ON	
BO OUT-2	Supply Fan 2 Command / SF2-C	Relay / VFD	✓	N/O	OFF	ON	
BO OUT-3							
Hardware Point	Point/Object Name	Field Device Type	CHK	Action (NO/NC)	Zero (Close)	Span (Open)	Note #
CO OUT-4	Preheat Output / PH-O	Valve	✓	N/O	0	100	
CO OUT-5	Cooling Output / CLG-O	Valve	✓	N/O	0	100	
CO OUT-6							
CO OUT-7							
Hardware Point	Point/Object Name	Field Device Type	CHK	Action (NO/NC)	Zero (Close)	Span (Open)	Note #
AO OUT-8	Supply Fan 1 Output / SF1-O	VFD	✓		0	100	
AO OUT-9	Supply Fan 2 Output / SF2-O	VFD	✓		0	100	
Power Panel		Panel Location				Circuit#	

() SYSTEM COMPL

(DATE) 6-26-15

TECH'S SIGNATURE

(DATE) 6-26-15

NOTES:

1. Intermediate Device used

2.

ACCEPTED BY:

DATE:

SMR-AHU-1_4(IOM 4710) Controller - Field Checkout

AHU-1

NAE#: 27
 MS/TP TRUNK: 2
 MS/TP ADDR: 7/4
 Zigbee PAN ID:

Controller Information		
Type	Trunk	Address
FAC 2611	2	7

CHECKOUT INFORMATION:

Hardware Point	Point/Object Name	Field Device Type	CHK	Field Value	Controller Value	AI# Offset	Note #
UI IN-1	Preheat Hot Water Ret Temp / HWR-T	Sensor	✓	86.0			
UI IN-2	Chilled Water Leaving Temperature / CHWR-T	Sensor	✓	63.4			
UI IN-3	Discharge Air Flow/ DA-F	Air Flow Station	✓	6550			
UI IN-4							
UI IN-5							
UI IN-6							
Hardware Point	Point/Object Name	Field Device Type	CHK	Action (NO/NC)	State 0	State 1	Note #
BI IN-7	PreFilter Status / PFILT-S	Owner Not Installed		N/O			
BI IN-8	Final Filter Status / FFILT-S	Owner Not Installed		N/O			
Hardware Point	Point/Object Name	Field Device Type	CHK	Action (NO/NC)	State 0	State 1	Note #
BO OUT-1	Heat Coil Pump 1 Command / HCP1-C	Pump Start Relay	✓				
BO OUT-2	Heat Coil Pump 1 Command / HCP1-C	Pump Stop Relay	✓				
BO OUT-3	AHU1 in Control of AHU2 / AHU1MASTER-C	Control to AHU-2	✓	N/O	OFF	ON	
Hardware Point	Point/Object Name	Field Device Type	CHK	Action (NO/NC)	Zero (Close)	Span (Open)	Note #
CO OUT-4	AHU1 Speed Control to AHU2 / AHU1VFD-OUT	Signal to AHU-2	✓		0	100	
CO OUT-5							
CO OUT-6							
CO OUT-7							
Hardware Point	Point/Object Name	Field Device Type	CHK	Action (NO/NC)	Zero (Close)	Span (Open)	Note #
AO OUT-8							
AO OUT-9							
Power Panel		Panel Location				Circuit#	

() SYSTEM COMPLETE

(DATE) 6-26-15

TECH'S SIGNATURE:

(DATE) 6-26-15

NOTES:

1. Intermediate Device used

2.

ACCEPTED BY:

DATE:

Job:
Proj. #:

	Pre-Functional Checks (PFC)			PFC Results (na, Y, N, #)			
	Equipment Plan ID:			AHU-1	AHU-1 VFDs	AHU-2	AHU-2 VFDs
	Item-1	Item-2	Item-3	Air Handling Unit - 1	AHU-1 Variable Frequency Drives	Air Handling Unit - 2	AHU-2 Variable Frequency Drives
Installation							
1	Equipment	Complete?					
2		Vendor?			na		na
3		SMRB Startup Checklists		na	na	na	na
4	Infra-Structure	Piping			na		na
5		Ductwork			na		na
6		Insulation			na		na
7		Electrical					
8		Safeties					
9		Controls					
10		Labeling					
Startup							
11	Safeties	Hardware-based					
12	Equipment	Vendor					
13		Installing Contractor			na		na
14	BAS Controls	IO					
15		Control Sequences					
16		Communication					
17		User Interface					
18	TAB	Hydronic	Prelim				
19			Final				
20		Air	Prelim				
21			Final				
22	Access	Routine O&M					
23		Repairs & Replacement					
PFC and FPT							
24	Pre-Cx	PFC	Date completed				
25			Initials				
26		BAS IO Check	Date completed				
27			Initials				

Job:
Proj. #:

	Pre-Functional Checks (PFC)			PFC Results (na, Y, N, #)			
	Equipment Plan ID:			AHU-3	AHU-3 VFDs	AHU-4	AHU-4 VFDs
	Item-1	Item-2	Item-3	Air Handling Unit - 3	AHU-3 Variable Frequency Drives	Air Handling Unit - 4	AHU-4 Variable Frequency Drives
Installation							
1	Equipment	Complete?					
2		Vendor?			na		na
3		SMRB Startup Checklists		na	na	na	na
4	Infra-Structure	Piping			na		na
5		Ductwork			na		na
6		Insulation			na		na
7		Electrical					
8		Safeties					
9		Controls					
10		Labeling					
Startup							
11	Safeties	Hardware-based					
12	Equipment	Vendor					
13		Installing Contractor			na		na
14	BAS Controls	IO					
15		Control Sequences					
16		Communication					
17		User Interface					
18	TAB	Hydronic	Prelim				
19			Final				
20		Air	Prelim				
21			Final				
22	Access	Routine O&M					
23		Repairs & Replacement					
PFC and FPT							
24	Pre-Cx	PFC	Date completed				
25			Initials				
26		BAS IO Check	Date completed				
27			Initials				

Job:
Proj. #:

Pre-Functional Checks (PFC)			PFC details and instructions
Equipment Plan ID:			Provide a Y or N (Yes or No) in the accompanying equipment listing. Provide keyed note #s where necessary.
Item-1	Item-2	Item-3	
Installation			
1	Equipment	Complete?	Installation completed by installing contractor (MC, PC, EC)?
2		Vendor?	Installation approved by vendor?
3		SMRB Startup Checklists	Installation verified against the approved SMRB <u>Startup Checklists</u> that were developed?
4	Infra-Structure	Piping	Piping connections and details complete?
5		Ductwork	Ductwork connections and details complete?
6		Insulation	Installation complete?
7		Electrical	Installation complete?
8		Safeties	Hardware safeties (pressure, temperature, air, current, voltage) installation complete?
9		Controls	Stand-alone controls (not BAS) installation complete?
10		Labeling	Labeling completed on equipment and connected infrastructure (duct, pipe)?
Startup			
11	Safeties	Hardware-based	Hardware safeties functional?
12	Equipment	Vendor	Vendor startup report received?
13		Installing Contractor	Installing contractor startup report received?
14	BAS Controls	IO	IO checklist and startup report received?
15		Control Sequences	Control sequences programmed?
16		Communication	Communication bus operational and functional for controller serving equipment?
17		User Interface	User interface complete? IO devices and related software points included on interface?
18	TAB	Hydronic	Preliminary TAB data received?
19		Final	Final TAB report received?
20		Air	Preliminary TAB data received?
21		Final	Final TAB report received?
22	Access	Routine O&M	Components and controls are accessible for routine maintenance operations.
23		Repairs & Replacement	Equipment and components can be readily removed and replaced, or with moderate effort.
PFC and FPT			
24	Pre-Cx	PFC	Date completed
25			Initials
26		BAS IO Check	Date completed
27			Initials

Job:
Proj. #:

Pre-Functional Checks (PFC)			PFC Results (na, Y, N, #)					
Equipment Plan ID:			VAV/RHC-	VAV/RHC-	VAV/RHC-	VAV/RHC-	VAV/RHC-	VAV/RHC-
Item-1	Item-2	Item-3						
Installation								
1	Equipment	Complete?						
2		Vendor?		na	na	na	na	na
3		SMRB Startup Checklists						
4	Infra-Structure	Piping						
5		Ductwork						
6		Insulation						
7		Electrical						
8		Safeties		na	na	na	na	na
9		Controls						
10		Labeling						
Startup								
11	Safeties	Hardware-based		na	na	na	na	na
12	Equipment	Vendor		na	na	na	na	na
13		Installing Contractor						
14	BAS Controls	IO						
15		Control Sequences						
16		Communication						
17		User Interface						
18	TAB	Hydronic	Prelim					
19			Final					
20		Air	Prelim					
21			Final					
22	Access	Routine O&M						
23		Repairs & Replacement						
PFC and FPT								
24	Pre-Cx	PFC	Date completed					
25			Initials					
26		BAS IO Check	Date completed					
27			Initials					

Job:
Proj. #:

Pre-Functional Checks (PFC)			PFC details and instructions
Equipment Plan ID:			Provide a Y or N (Yes or No) in the accompanying equipment listing. Provide keyed note #s where necessary.
Item-1	Item-2	Item-3	
Installation			
1	Equipment	Complete?	Installation completed by installing contractor (MC, PC, EC)?
2		Vendor?	Installation approved by vendor?
3		SMRB Startup Checklists	Installation verified against the approved SMRB <u>Startup Checklists</u> that were developed?
4	Infra-Structure	Piping	Piping connections and details complete?
5		Ductwork	Ductwork connections and details complete?
6		Insulation	Installation complete?
7		Electrical	Installation complete?
8		Safeties	Hardware safeties (pressure, temperature, air, current, voltage) installation complete?
9		Controls	Stand-alone controls (not BAS) installation complete?
10		Labeling	Labeling completed on equipment and connected infra-structure (duct, pipe)?
Startup			
11	Safeties	Hardware-based	Hardware safeties functional?
12	Equipment	Vendor	Vendor startup report received?
13		Installing Contractor	Installing contractor startup report received?
14	BAS Controls	IO	IO checklist and startup report received?
15		Control Sequences	Control sequences programmed?
16		Communication	Communication bus operational and functional for controller serving equipment?
17		User Interface	User interface complete? IO devices and related software points included on interface?
18	TAB	Hydronic	Prelim
19			Final
20		Air	Prelim
21			Final
22	Access	Routine O&M	Components and controls are accessible for routine maintenance operations.
23		Repairs & Replacement	Equipment and components can be readily removed and replaced, or with moderate effort.
PFC and FPT			
24	Pre-Cx	PFC	Date completed
25			Initials
26		BAS IO Check	Date completed
27			Initials

Job:	
Proj.#:	

System:	Air Handling Unit
Cx Agent Name:	
Date start/end:	

Inputs				
1	2	3	4	5
Supply Fan 1 Status	Supply Fan 2 Status	Discharge Air Temperature	Discharge Air Pressure 1	Discharge Air 1 Flow

C1	Point Definition	ToD					
1.1	Point Name (BAS submittal)	___:___	SF1-S	SF2-S	DA-T	DA1-P	DA1-F
1.2	Point Type (A/B, I/O)	___:___	BI	BI	AI	AI	AI
1.3	Value	___:___					
1.4	Units	___:___					
1.5	Auto/Man	___:___					
1.6	Trend logs - Type: - Sample rate:	___:___					
	P/F:	n/a					

C2	IO Check	ToD					
2.1	BI/BO - Low Value	___:___			na	na	na
2.2	BI/BO - High Value	___:___			na	na	na
2.3	AI/O - Low Value	___:___	na	na			
2.4	AI/O - Mid or Setpoint Value	___:___	na	na			
2.5	AI/O - Hi Value	___:___	na	na			
	P/F:	n/a					

Job:	
Proj. #:	

System:	Air Handling Unit
Cx Agent Name:	
Date start/end:	

Inputs				
1	2	3	4	5
Supply Fan 1 Status	Supply Fan 2 Status	Discharge Air Temperature	Discharge Air Pressure 1	Discharge Air 1 Flow

C3 VFD Settings ToD							
3.1	VFD Accel Rate	—:—	na	na	na	na	na
3.2	VFD Decel Rate	—:—	na	na	na	na	na
	P/F:	n/a	na	na	na	na	na
C4 Actuator Speed ToD							
4.1	Stroke Time	—:—	na	na	na	na	na
4.2	Spring Return NO or NC	—:—	na	na	na	na	na
	P/F:	n/a	na	na	na	na	na
C5 CT Status ToD							
5.1	Belt/Coupling Failure	—:—			na	na	na
5.2	Pump/Fan Failure	—:—			na	na	na
	P/F:	n/a			na	na	na

Job:	
Proj. #:	

System: Air Handling Unit				
Cx Agent Name:				
Date start/end:				
6	7	8	9	10
Discharge Air 2 Flow	Discharge Air Humidity	Mixed Air Temperature	Heat Coil Pump 1 Status	Preheat Temperature

C1 Point Definition		ToD					
1.1	Point Name (BAS submittal)	_____:	DA2-F	DA-H	MA-T	HCP1-S	PH-T
1.2	Point Type (A/B, I/O)	_____:	AI	AI	AI	BI	AI
1.3	Value	_____:					
1.4	Units	_____:					
1.5	Auto/Man	_____:					
1.6	Trend logs - Type: - Sample rate:	_____:					
	P/F:	n/a					
C2 IO Check		ToD					
2.1	BI/BO - Low Value	_____:	na	na	na		na
2.2	BI/BO - High Value	_____:	na	na	na		na
2.3	AI/O - Low Value	_____:				na	
2.4	AI/O - Mid or Setpoint Value	_____:				na	
2.5	AI/O - Hi Value	_____:				na	
	P/F:	n/a					

Job:	
Proj. #:	

System:	Air Handling Unit
Cx Agent Name:	
Date start/end:	

6	7	8	9	10
Discharge Air 2 Flow	Discharge Air Humidity	Mixed Air Temperature	Heat Coil Pump 1 Status	Preheat Temperature

C3 VFD Settings		ToD					
3.1	VFD Accel Rate	____:____	na	na	na	na	na
3.2	VFD Decel Rate	____:____	na	na	na	na	na
	P/F:	n/a	na	na	na	na	na
C4 Actuator Speed		ToD					
4.1	Stroke Time	____:____	na	na	na	na	na
4.2	Spring Return NO or NC	____:____	na	na	na	na	na
	P/F:	n/a	na	na	na	na	na
C5 CT Status		ToD					
5.1	Belt/Coupling Failure	____:____	na	na	na		na
5.2	Pump/Fan Failure	____:____	na	na	na		na
	P/F:	n/a	na	na	na		na

Job:	
Proj. #:	

System:	Air Handling Unit
Cx Agent Name:	
Date start/end:	

11	12	13	14	15
Hot Water Return Temperature	Chilled Water Return Temperature	Pre-Filter Status	Final Filter Status	Low Temp. Alarm

C1 Point Definition		ToD					
1.1	Point Name (BAS submittal)	____:____	HWR-T	CHWR-T	PFILT-S (Future)	FFILT-S (Future)	LT-A
1.2	Point Type (A/B, I/O)	____:____	AI	AI	UI	UI	AI
1.3	Value	____:____			na	na	
1.4	Units	____:____			na	na	
1.5	Auto/Man	____:____			na	na	
1.6	Trend logs - Type: - Sample rate:	____:____			na	na	
	P/F:	n/a			na	na	
C2 IO Check		ToD					
2.1	BI/BO - Low Value	____:____	na	na	na	na	na
2.2	BI/BO - High Value	____:____	na	na	na	na	na
2.3	AI/O - Low Value	____:____			na	na	
2.4	AI/O - Mid or Setpoint Value	____:____			na	na	
2.5	AI/O - Hi Value	____:____			na	na	
	P/F:	n/a					

Job:	
Proj. #:	

System:	Air Handling Unit
Cx Agent Name:	
Date start/end:	

11	12	13	14	15
Hot Water Return Temperature	Chilled Water Return Temperature	Pre-Filter Status	Final Filter Status	Low Temp. Alarm

C3 VFD Settings		ToD					
3.1	VFD Accel Rate	____:____	na	na	na	na	na
3.2	VFD Decel Rate	____:____	na	na	na	na	na
	P/F:	n/a	na	na	na	na	na
C4 Actuator Speed		ToD					
4.1	Stroke Time	____:____	na	na	na	na	na
4.2	Spring Return NO or NC	____:____	na	na	na	na	na
	P/F:	n/a	na	na	na	na	na
C5 CT Status		ToD					
5.1	Belt/Coupling Failure	____:____	na	na	na	na	na
5.2	Pump/Fan Failure	____:____	na	na	na	na	na
	P/F:	n/a	na	na	na	na	na

Job:	
Proj. #:	

System: Air Handling Unit			
Cx Agent Name:			
Date start/end:			
16	17	18	19
Discharge Air Hi Press. Alarm	Mixed Air Low Press. Alarm	Return Air Pressure Low Press. Alarm	Fire/Smoke Alarm Status

C1 Point Definition		ToD				
1.1	Point Name (BAS submittal)	_____:	DAPHI-A	MAPLO-A	RAPLO-A	SMK-A
1.2	Point Type (A/B, I/O)	_____:	BI	BI	BI	BI
1.3	Value	_____:				
1.4	Units	_____:				
1.5	Auto/Man	_____:				
1.6	Trend logs - Type: - Sample rate:	_____:				
	P/F:	n/a				
C2 IO Check		ToD				
2.1	BI/BO - Low Value	_____:				
2.2	BI/BO - High Value	_____:				
2.3	AI/O - Low Value	_____:	na	na	na	na
2.4	AI/O - Mid or Setpoint Value	_____:	na	na	na	na
2.5	AI/O - Hi Value	_____:	na	na	na	na
	P/F:	n/a				

Job:	
Proj. #:	

System: Air Handling Unit			
Cx Agent Name:			
Date start/end:			
16	17	18	19
Discharge Air Hi Press. Alarm	Mixed Air Low Press. Alarm	Return Air Pressure Low Press. Alarm	Fire/Smoke Alarm Status

C3 VFD Settings		ToD				
3.1	VFD Accel Rate	____:____	na	na	na	na
3.2	VFD Decel Rate	____:____	na	na	na	na
	P/F:	n/a	na	na	na	na
C4 Actuator Speed		ToD				
4.1	Stroke Time	____:____	na	na	na	na
4.2	Spring Return NO or NC	____:____	na	na	na	na
	P/F:	n/a	na	na	na	na
C5 CT Status		ToD				
5.1	Belt/Coupling Failure	____:____	na	na	na	na
5.2	Pump/Fan Failure	____:____	na	na	na	na
	P/F:	n/a	na	na	na	na

Job:	
Proj. #:	

System:	Air Handling Unit
Cx Agent Name:	
Date start/end:	

Outputs						
1	2	3	4	5	6	7
Supply Fan 1 Command	Supply Fan 1 Output Speed	Supply Fan 2 Command	Supply Fan 2 Output Speed	Heating Coil Pump Command	Preheat Output	Cooling Output

C1 Point Definition ToD									
1.1	Point Name (BAS submittal)	___:___	SF1-C	SF1-O	SF2-C	SF2-O	HCP1-C	PH-O	CLG-O
1.2	Point Type (A/B, I/O)	___:___	BO	AO	BO	AO	BO	AO	AO
1.3	Value	___:___							
1.4	Units	___:___							
1.5	Auto/Man	___:___							
1.6	Trend logs - Type: - Sample rate:	___:___							
	P/F:	n/a							
C2 IO Check ToD									
2.1	BI/BO - Low Value	___:___		na		na		na	na
2.2	BI/BO - High Value	___:___		na		na		na	na
2.3	AI/O - Low Value	___:___	na		na		na		
2.4	AI/O - Mid or Setpoint Value	___:___	na		na		na		
2.5	AI/O - Hi Value	___:___	na		na		na		
	P/F:	n/a							

Job:	
Proj. #:	

System:	Air Handling Unit
Cx Agent Name:	
Date start/end:	

Outputs						
1	2	3	4	5	6	7
Supply Fan 1 Command	Supply Fan 1 Output Speed	Supply Fan 2 Command	Supply Fan 2 Output Speed	Heating Coil Pump Command	Preheat Output	Cooling Output

C3 VFD Settings ToD									
3.1	VFD Accel Rate	—:—	na		na		na	na	na
3.2	VFD Decel Rate	—:—	na		na		na	na	na
	P/F:	n/a	na		na		na	na	na

C4 Actuator Speed ToD									
4.1	Stroke Time	—:—	na	na	na	na	na		
4.2	Spring Return NO or NC	—:—	na	na	na	na	na		
	P/F:	n/a	na	na	na	na	na		

C5 CT Status ToD									
5.1	Belt/Coupling Failure	—:—	na	na	na	na	na	na	na
5.2	Pump/Fan Failure	—:—	na	na	na	na	na	na	na
	P/F:	n/a	na	na	na	na	na	na	na

Job:	General Notes: "F" indicates a field entered value. "TP" indicates a test procedure. Insert date MM/DD/YY. "ER" indicates an expected response. Pass indicated by ✓ ; Fail indicated by # with corresponding keyed note.
Proj:	
Cx Agents:	
Date:	

Equipment ID:		AHU-1	AHU-2
Location			
Service			
PFC Verification			
TP	Prior to testing, verify that AHU is ready for FPT.	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	PFC received		
Alarms, Safeties and Interlocks			
Smoke detection in AHU			
TP	Very supply/return duct detector will shut down the AHU when tripped	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	AHU shuts down		
AHU Shutdown w/Alarm at BAS			
TP	Trip the low static pressure switch on the return duct section	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	AHU shuts down		
ER	RA low static pressure alarm at the FMCS (LED in DDC panel)		
F	RA low static trip limit setting at field device (in-wc)		
TP	Trip the low static pressure switch at the MA section	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	AHU shuts down		
ER	MA low static pressure alarm at the FMCS (LED in DDC panel)		
F	RA low static trip limit setting at field device (in-wc)		
TP	Trip the high static pressure switch on the supply duct	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	AHU shuts down		
ER	SA high static pressure alarm at the FMCS (LED in DDC panel)		
F	SA High static trip limit setting at field device (in-wc)		
TP	Trip the freeze stat (6 wired in series)	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	AHU shuts down		
ER	Freeze stat alarm at the FMCS (LED in DDC panel). Test each of six (6) sections.		

Equipment ID:		AHU-1	AHU-2
AHU Continued Operation w/Alarm at BAS			
TP	Simulate heating pump failure	___/___/___ __: __ AM/PM	___/___/___ __: __ AM/PM
ER	AHU continues to run		
ER	Pump status alarm indicated at the FMCS		
TP	Release alarm		
ER	Pump status alarm cleared at the FMCS		
TP	Create an alarm condition at each supply fan VFD	___/___/___ __: __ AM/PM	___/___/___ __: __ AM/PM
ER	AHU continues to run		
ER	SF-1 VFD alarm indicated at the FMCS		
ER	SF-2 VFD alarm indicated at the FMCS		
TP	Release alarm		
ER	VFD alarm cleared at the FMCS		
TP	Simulate DA-T 5F above setpoint	___/___/___ __: __ AM/PM	___/___/___ __: __ AM/PM
F	DA-T Setpoint		
F	DA-T		
ER	AHU continues to run		
ER	DA-T alarm indicated at the FMCS		
nis	Record time delay prior to alarm at FMCS		
TP	Release alarm		
F	DA-T alarm cleared at the FMCS		
TP	Simulate DA-T 5F below setpoint	___/___/___ __: __ AM/PM	___/___/___ __: __ AM/PM
F	DA-T		
F	DA-T Setpoint		
ER	AHU continues to run		
ER	DA-T alarm indicated at the FMCS		
nis	Record time delay prior to alarm at FMCS		
TP	Release alarm		
F	DA-T alarm cleared at the FMCS		

Equipment ID:		AHU-1	AHU-2
AHU Shut down			
TP	Shut down the AHU ("Run" Command)	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	Isolation dampers close		
ER	HC HWP and HW control valve shall remain under control of its input sensor		
F	HW valve position		
F	HW pump status		
ER	All fire/smoke dampers 100% closed		
ER	Isolation dampers 100% closed		
ER	ChW valve closes		
ER	Supply fan VFDs "off"		
TP	Test continued HC control during shutdown, $38 < OA < 50$.	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	HWC valve modulates to maintain DA-T		
ER	HWP operates when HWC valve $> 0\%$ open		
TP	Test continued HC control during shutdown, $OA < 38$.	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	HWC valve modulates to maintain DA-T		
ER	HWP operates continuously		
AHU indexed to run			
AHU Enabled			
TP	Command AHU "on"	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	Supply fan VFDs SF-1 and SF-2 start		
ER	Both VFDs go to 22% until isolation dampers prove open		
ER	MA isolation damper opens		
ER	SA isolation damper opens		
F	Record time until isolation dampers are 100% open		
ER	Supply fan modulates to maintain static pressure of 1.5"		
F	Record fan speed		
F	Record duct static pressures: AH1-3rd flr, AH2-6th flr, AH3-Bsmt, AH4-6th flr		
F	Record duct static pressure set point		

Equipment ID:		AHU-1	AHU-2
AHU Fan Failures			
AHU Enabled			
TP	Fail both SF-1 and SF-2	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
ER	Isolation dampers close		
ER	HC maintains control (pump and valve)		
ER	CHW valve closes		
ER	VFD de-energized		
ER	Alarm received at FMCS		
DA-T Setpoint			
TP	Simulate OA-T above 60F	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
F	OA-T		
ER	DA-T setpoint resets to 55F		
TP	Simulate OA-T between 50F and 60F	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
F	OA-T		
F	DA-T		
ER	DA-T setpoint resets from 55F-60F for OA 60F-50F		
TP	Simulate OA-T below 50F	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
F	OA-T		
ER	DA-T setpoint resets to 60F		
Ventilation			
TP	Verify that the return air damper modulates to maintain building pressure at +.01 in-wc.	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
F	Building StPr set-point (in-wc)		
F	Return air damper position		
F	Building static pressures at BLDG3-P (6th flr South), BLDG2-P (3rd flr North), BLDG-1P (1st flr South)		
TP	RA damper modulates in response to increased setpoint.	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
F	Building StPr set-point (in-wc)		
F	Return air damper position		
F	Building static pressures at BLDG3-P (6th flr South), BLDG2-P (3rd flr North), BLDG-1P (1st flr South)		
TP	RA damper modulates in response to decreased setpoint.	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
F	Building StPr set-point (in-wc)		
F	Return air damper position		
F	Building static pressures at BLDG3-P (6th flr South), BLDG2-P (3rd flr North), BLDG-1P (1st flr South)		

Equipment ID:		AHU-1	AHU-2
Cooling Coil Operation			
TP	Simulate a call for increased cooling	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
F	DA-T		
F	ChW valve position		
ER	ChW valve modulates to maintain DA-T		
TP	Simulate a call for decreased cooling	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
F	DA-T		
F	ChW valve position		
ER	ChW valve modulates to maintain DA-T		
Heating Coil Operation			
TP	OA-T above 54F	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	Preheat coil controls disabled		
TP	Create DA-T << set-point by manipulating DA-T setpoint and CHW valve		
ER	Preheat coil controls disabled		
TP	OA-T between 50F and 38F	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	Preheat coil controls enabled; Pump runs if valve opens.		
TP	Create DA-T << set-point by manipulating DA-T setpoint and CHW valve		
F	PH-T, DA-T		
F	DA-T setpoint		
F	HC Valve		
F	HC Pump		
TP	OA-T less than 38F	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
ER	Preheat coil controls enabled; Pump runs continuously.		
TP	Create DA-T << set-point by manipulating DA-T setpoint and CHW valve		
F	PH-T, DA-T		
F	DA-T setpoint		
F	HC Valve		
F	HC Pump		
TP	Create DA-T >= set-point by manipulating DA-T setpoint and CHW valve	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
F	PH-T, DA-T		
F	DA-T setpoint		
F	HC Valve		
F	HC Pump		
F	CHW valve		

Equipment ID:		AHU-1	AHU-2
Airflow Calculations			
TP	OA = sum(SA) - RA	___/___/___ :___ AM/PM	___/___/___ :___ AM/PM
F	SA SF-1 (for each of 4 AHUs)		
F	SA SF-2 (for each of 4 AHUs)		
F	RA		
ER	OA (calc'd) = sum(SA) - RA		
FPT Keyed Notes			
#	Description		
1			
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6			
7			
8			
9			
10			
11			
12			
13			
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19			
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FPTs

Job:
Proj:
Cx Agents:
Date:

General Notes:

"F" indicates a field recorded value. Provide data as required.
 "TP" - Test condition set by CxA; CxA must enter date/time test condition set.
 "D" - Design data or requirements. Typically entered prior to FPT.
 "ER" - Response: measured, reported (BAS)
 Fail indicated by # with corresponding keyed note.

Equipment ID:	VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC
Plan ID:					
Location:					

Alarms, Safeties, and Interlocks

Objective: Space temperature alarm

TP	Simulate the high space temperature alarm (83F)	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM
F	Space temperature set point					
F	Space temperature					
ER	Space temperature alarm generated at the FMCS operator workstation					
TP	Simulate the low space temperature alarm (63F)	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM
F	Space temperature set point					
F	Space temperature					
ER	Space temperature alarm generated at the FMCS operator workstation					

Multiple Zone Thermostats

Objective: Verify zones with multiple thermostats correctly average

TP	Locate zone that has multiple thermostats	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM	___/___/___ ___:___AM/PM
F	Zone temperature 1					
F	Zone temperature 2					
F	Zone temperature 3					
F	Average space temperature					
ER	VAV correctly averages all space temperatures					

FPTs

Equipment ID:		VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC
Plan ID:						
Occupied Mode						
Objective: Space temperature maintained						
TP	Place the VAV in occupied mode and verify that the room air temperature is equal to set point	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
TP	Set the warm/cool adjust to 0 offset	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
F	Space temperature set point					
F	Warm/cool adjustment					
F	Effective heating setpoint					
F	Effective cooling setpoint					
F	Space temperature					
D	Minimum Airflow					
F	Flow setpoint					
ER	Actual flow setpoint equals Design Minimum Airflow					
F	Actual airflow					
ER	Primary air damper maintains airflow setpoint					
ER	Reheat valve is closed.					
F	Discharge air temperature					
ER	Discharge air temperature equals primary air temperature (from main AHU)					
TP	Place the VAV in unoccupied mode to verify that the air flow set point resets to the correct value	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
D	Minimum Airflow					
ER	Primary air damper maintains correct Min airflow setpoint					
TP	Place the VAV in occupied mode	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM

FPTs

Equipment ID:		VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC
Plan ID:						
Occupied Mode						
Objective: Minimal cooling call						
TP	Simulate room air temperature above the effective cooling set point	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM
TP	Set warm/cool adjust to max cooling offset	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM
F	Space temperature set point					
F	Warm/cool adjustment					
F	Effective heating setpoint					
F	Effective cooling setpoint					
F	Space temperature					
D	Minimum airflow setpoint					
D	Maximum airflow setpoint					
F	Flow setpoint					
ER	Actual flow setpoint between Design Min & Max Airflow					
ER	Primary air damper maintains correct flow setpoint					
ER	Reheat valve is closed.					
F	Discharge air temperature					
ER	Discharge air temperature is equal to air temperature leaving from the AHU					
Occupied Mode						
Objective: Full cooling call						
TP	Simulate space temperature well above effective cooling setpoint.	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM	___/___/___ : AM/PM
F	Space temperature set point					
F	Warm/cool adjustment					
F	Effective heating setpoint					
F	Effective cooling setpoint					
F	Space temperature					
F	Flow setpoint					
ER	Actual flow setpoint equals Design Maximum Airflow					
ER	Primary air damper maintains correct flow setpoint					
ER	Reheat valve is closed.					
F	Discharge air temperature					
ER	Discharge air temperature is equal to air temperature leaving from the AHU					

FPTs

Equipment ID:		VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC
Plan ID:						
Occupied Mode						
Objective: Minimal heating call						
TP	Simulate room air temperature below the effective heating set point	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
TP	Set warm/cool adjust to the max heating offset	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
F	Space temperature set point					
F	Warm/cool adjustment					
F	Effective heating setpoint					
F	Effective cooling setpoint					
F	Space temperature					
F	Flow setpoint					
ER	Actual flow setpoint equals Design Minimum Airflow					
ER	Primary air damper maintains correct flow setpoint					
ER	Reheat valve modulates to maintain zone temperature setpoint.					
F	Discharge air temperature					
ER	Discharge air temperature does not exceed space temperature by more than 20F.					
TP	Place the VAV in unoccupied mode to verify that the air flow set point resets to the correct value	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM
D	Minimum Airflow					
ER	Primary air damper maintains correct Min airflow setpoint					
TP	Place the VAV in occupied mode	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM	___/___/___ __: __AM/PM

FPTs

Equipment ID:		VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC	VAV/RHC
Plan ID:						
Occupied Mode						
Objective: Full heating call						
TP	Simulate space temperature well below effective heating setpoint.	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM	___/___/___ ___:___ AM/PM
F	Space temperature set point					
F	Warm/cool adjustment					
F	Effective heating setpoint					
F	Effective cooling setpoint					
F	Space temperature					
F	Flow setpoint					
F	Actual airflow					
ER	Primary air damper maintains setpoint					
ER	Reheat valve modulates to maintain zone temperature setpoint.					
F	Discharge air temperature					
ER	Discharge air temperature does not exceed 20F more than the space temperature					

FPT Keyed Notes

#	Description	Issue #	Status
1			
2			
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10			

PROJECT:	
TEST DATE:	
TEST TOPIC:	Standby power test.
R&B PROJECT NO.	
Cx TEAM:	

1. Objective

Direct a full building power outage on September 10, 2015, and observe responses of critical building systems.

2. Methodology**Timeline: Thursday 9/10/2015**

- 0830am Set up BAS laptop in basement.
Notify Owner of pending outage.
- 0900am Meet Contractor and Electrical Contractor reps on-site.
- 0915am Electrical Contractor shuts down D feed.
- 0930am Electrical Contractor shuts down W feed.
- 1000am Electrical Contractor re-energizes D and W feeds.
- 1015am Notify Owner operators of conclusion of test.
- 1030am Test results review.

Set-up

1. Set up BAS laptop (CRW)
2. Confirm trend data is set up
3. Station observers at building locations
4. Contact Owner operators

3. Field Observations

Pre-Outage: Critical	Observations	Comments
1. Power readings	D-feeder kW, V, A, pf W-feeder kW, V, A, pf	
2. BAS controllers are all on-line (Offline controllers report)	NAEs FC busses LON busses	
3. Generator on-line	Alarms Damper	
4. UPS on-line	5 th floor	
5. Fire pumps in auto	Main Jockey	
6. Pressurization fans in auto	SF-1 SF-2 SF-3 SF-4	
7. Gen SF in auto	SF-5	
8. LEF-1 in auto	LEF-1	
9. Sump pumps in auto	SP-1 (San) SP-2 (Storm) SP-3 (Pass. Elev) SP-4 (Freight Elev)	
10. HW pumps in auto	HWP-1 HWP-2 Heating plant	
11. Egress lighting	West exit Lobby exit East exit	
12. Fire alarm remote monitoring is on-line		
13. BAS remote monitoring is on- line	Control room	
14. Security remote monitoring is on-line	Access control CCTV	
15. IT remote monitoring is on-line		
Pre-Outage: Non-Crit	Observations	Comments
16. HVAC systems on-line	Cooling plant Penthouse AHUs 1-4 AHUs 5, 6, 7	

Outage Source 1: Critical	Observations	Comments
17. Power readings	D-feeder kW, V, A, pf W-feeder kW, V, A, pf	
18. BAS controllers remain on-line (Offline controllers report)	NAEs FC busses LON busses	
19. Fire alarm remote monitoring is on-line		
20. BAS remote monitoring is on- line	Control room	
21. Security remote monitoring is on-line	Access control CCTV	
22. IT remote monitoring is on-line		

Outage Source 1: Non-Crit	Observations	Comments
23. HVAC systems on-line	Cooling plant Penthouse AHUs 1-4 AHUs 5, 6, 7	
24. Power readings	D-feeder kW, V, A, pf W-feeder kW, V, A, pf	

Full Outage: Critical	Observations	Comments
25. Power readings	D-feeder kW, V, A, pf W-feeder kW, V, A, pf Generator	
26. BAS controllers are all on-line (Offline controllers report)	NAEs FC busses LON busses	
27. Generator status	Alarms Damper	
28. UPS status	5 th floor	
29. Fire pumps status	Main Jockey	
30. Gen SF status	SF-5	
31. LEF-1 status	LEF-1	
32. Sump pumps status	SP-1 (San) SP-2 (Storm) SP-3 (Pass. Elev) SP-4 (Freight Elev)	
33. HW pumps status	HWP-1 HWP-2 Heating plant	
34. Egress lighting status	West exit Lobby exit East exit	
35. Fire alarm remote monitoring is on-line		
36. BAS remote monitoring is on- line	Control room	
37. Security remote monitoring is on-line	Access control CCTV	
38. IT remote monitoring is on-line		

Full Outage: Non-Crit	Observations	Comments
39. HVAC systems status	Cooling plant Penthouse AHUs 1-4 AHUs 5, 6, 7	
40. Power readings	D-feeder kW, V, A, pf W-feeder kW, V, A, pf Generator	

Normal Power: Critical	Observations	Comments
41. Power readings	D-feeder kW, V, A, pf W-feeder kW, V, A, pf	
42. BAS controllers are all on-line (Offline controllers report)	NAEs FC busses LON busses	
43. Generator on-line	Alarms Damper	
44. UPS on-line	5 th floor	
45. Fire pumps in auto	Main Jockey	
46. Pressurization fans in auto	SF-1 SF-2 SF-3 SF-4	
47. Gen SF in auto	SF-5	
48. LEF-1 in auto	LEF-1	
49. Sump pumps in auto	SP-1 (San) SP-2 (Storm) SP-3 (Pass. Elev) SP-4 (Freight Elev)	
50. HW pumps in auto	HWP-1 HWP-2 Heating plant	
51. Egress lighting	West exit Lobby exit East exit	
52. Fire alarm remote monitoring is on-line		
53. BAS remote monitoring is on- line	Control room	
54. Security remote monitoring is on-line	Access control CCTV	
55. IT remote monitoring is on-line		

Normal Power: Non-Crit	Observations	Comments
56. HVAC systems on-line	Cooling plant Heating plant Penthouse AHUs 1-4 AHUs 5, 6, 7	
57. Power readings	D-feeder kW, V, A, pf W-feeder kW, V, A, pf	

4. Test Conclusion

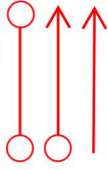
1. Notify Owner.
2. Report results.

End of report

SAMPLE

Symbols

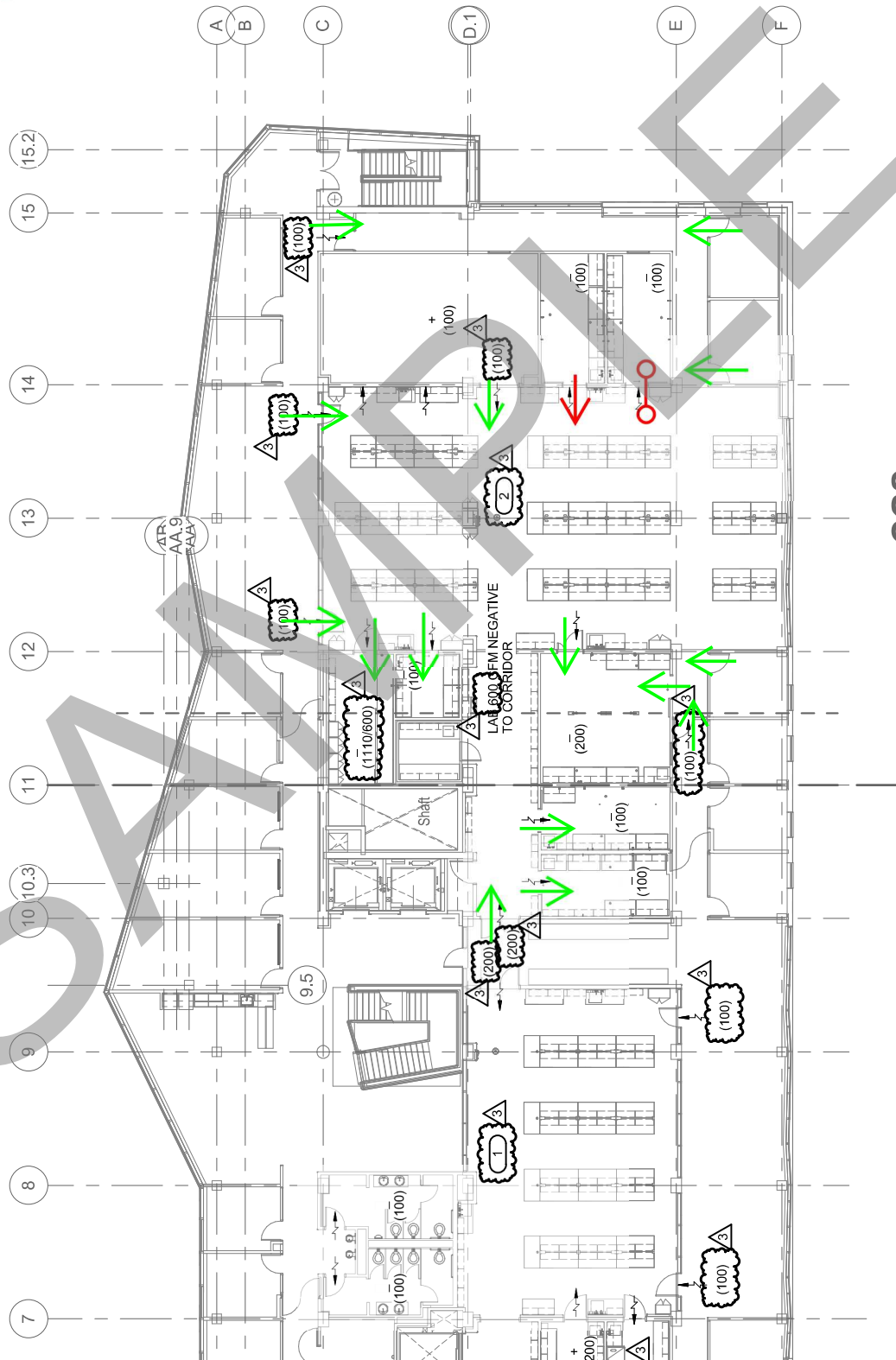
Does not match design intent



Matches design intent



Space Pressure Test - Smoke Test Diagram



PROJECT:	WUSM SMRB
REPORT DATE:	September 18, 2015
REPORT TOPIC:	Domestic Water System Testing
R&B PROJECT NO.	885-88
Cx TEAM:	KJM, CRW

1 Objective

Perform functional performance tests on the domestic water system on Friday 9/11/2015. This includes the domestic booster pump, domestic water heaters, the mixing valves, emergency shower and eye wash stations, and hot water plumbing fixtures.

2 Field Observations

- 1) The booster pump was able to maintain set point and alarm to the BAS.
- 2) The domestic water heaters were able to maintain a hot water temperature set point of 140°F. The hot water set point is reported to have been adjusted to 130°F, as recommended by the vendor. This was in response to alarms on a water heater when operating at the higher set point.
 - a. Hot water heaters were not labeled.
- 3) The mixing valves were able to maintain set point.
 - a. Mixing valves were not labeled.

	Mixing Valve 1 – Hot water to all building fixtures (setpoint = 115°F)	Mixing Valve 2 – Tempered water to all emergency fixtures (setpoint = 65-90°F)
Entering hot water temperature	125°F	129°F
Entering cold water temperature	100°F	89°F
Leaving hot water temperature	115°F	91°F

- 4) Emergency shower and eye wash stations functioned correctly and the leaving water temperature was confirmed.

Basement eyewash/emergency shower	92°F /92°F
3 rd floor eyewash/emergency shower	92°F /92°F
6 th floor eyewash/emergency shower	92°F /93°F

- 5) Plumbing fixtures were able to deliver hot water at the correct flow rate and temperature.

Basement sink hot water temperature	108°F
3 rd floor sink hot water temperature	114°F
6 th floor sink hot water temperature	113°F

3 Recommendations

- 1) Provide labels for the mixing valves and domestic water heaters.

4 Upcoming Work

- 2) Basement lab terminal units FPT.
- 3) 3rd floor west and 5th floor laboratory pressurization tests.

End of report

PROJECT:	
REPORT DATE:	
REPORT TOPIC:	Seasonal Heating Test and Site Observations
R&B PROJECT NO.	
Cx TEAM:	

1. Objectives

Ross & Baruzzini conducted a seasonal heating test on Monday 1/18/2016 during the morning when outside air temperatures were well below freezing (~12°F). Primary systems were monitored in the field to verify they were performing correctly. Terminal units on the 3rd, 4th, 5th, and 6th floors and the stair well fan coil units were monitored through the BAS to verify their abilities to maintain temperature set point.

2. Observations

Seasonal Heating Test

1. 60% (52 VAVs) were in heating mode.
 - o 22 of those VAVs had space temperatures at least 2°F below the heating set point.
 - o 10 of those VAVs had space temperatures at least 3°F below the heating set point.
2. 33% (28 VAVs) had space temperatures satisfied.
3. The following VAVs had space temperatures more than 7°F below the heating set point.

Unit Name	Area Served	Space Temperature	Eff. Heating Set point
VAV-4001B	Seminar – North	62.5	73.5
VAV-4008A	Nook – North East	64.9	72.1
VAV-6202	Office - North	63.4	74

- o VAV-6202 was previously reported on the last seasonal heating test.
 - o VAV-4001B had a low discharge air temperature despite the valve being open 100%.
4. Based on information retrieved on 1/20/2015, the VAVs that were more than 2°F below the heating set point appear to be limited by the heating maximum airflow.
 5. VAV-5008A that serves the North East Nook had its heating valve open 100% and a discharge air temperature of 115.4°F.
 6. FCU-1008A was in a low temperature alarm with the zone temperature at 59.7°F. The discharge air temperature point for the unit showed as “unreliable” on the BAS.
 7. The steam valves show signs of short cycling between the 1/3 and 2/3 valves.
 8. The steam condensate pump came on every 4 minutes during 10°F weather.
 9. Generator door was propped open at the time of testing.
 10. Trend logs showed that the generator room space temperature reached 31.7°F when outside air temperature was at 7°F.
 11. Air curtain functioned correctly after adjusting the door contact. The door contact operation is still questionable.
 12. Penthouse AHU's heating valves were all open 55% or less.
 13. Penthouse AHU Return air damper was 80% open and building maintaining a building pressure of 0.015 in wc.
 14. The cooling tower basin did not have any visible signs of freezing. The tower basin temperature fluctuates between 36°F and 39°F.

Site Observations

15. Occupancy sensor review:
 - o Room B113 and B110 had the lights on when the BAS showed the spaces to be unoccupied. The BAS status changed to occupied upon entry.
 - o Room B209 lights were off and the BAS space status was occupied. Lights came on after entering the space.

- o Room B116 lights were on and space shows occupied since 1/15/2016 on BAS.
 - o Room B208 lights were on and space shows occupied since 1/16/2016 on BAS.
16. Glycol pumps both displayed a pump speed of 0% on the BAS and JCI panel in the field despite being shown to be on and verified to be running in the field.

3. **Conclusions**

1. Overall the terminal units that were not maintaining space temperature set point appeared to have the ability to increase the amount of heat delivered to their space if not limited by the maximum heating airflow set point.

4. **Recommendations**

The following items are entered in BIM360

1. Correct issue with VAV-4001B having low DA-T despite heating valves being open 100%.
2. Verify that VAV-5008A has a high temperature limit on its DA-T.
3. Correct the FCU-1008A's discharge air temperature point on the BAS.
4. Investigate loop tuning for the steam valves.
5. Correct the door contact for the air curtain.
6. Correct the lighting/BAS issues found in the basement.
7. Correct the issue of the glycol pumps speed showing up on the BAS.

5. **Future Work**

1. Schedule an extreme cold weather run test for the Generator.

End of report

Project:	
Job #:	
Scope:	Cx: LEED Fund & Enh

Issue ID:	Phase:	Current Owner	Status:	Obs. Date:	Location	System1- General	System2: Detail	Description:	Suggested Response:	Reply/Follow-Up:
2-1	LEED		Open	13-Mar-13	na	LEED Meeting 2/25/2013	Basis of Design	No matrix of space requirements available. Submitted sample space matrix format.	Requested space design requirements matrix from 2014-03-14: Include hrs of operation (KH).	4/24/13 review: - Unocc requirements missing. - No lighting (FC) requirements provided. - No sound performance criteria for spaces (dB) provided. 2014-01-08 examples: -Environmental rooms -Glass wash -Freezer farm.
18-1	LEED		Open	13-Mar-13	na	SD set 3/4/13	Project Manual - Core and Shell - Plbg	Section B: "Pumped basement" concept missing in narrative.	Provide.	4/24/13 review: Missing from SD narrative.
27-1	LEED		Open	13-Mar-13	na	SD set 3/4/13	Project Manual - Fit-Out Systems - Mech	Section A.1: Maintaining proper space pressures in labs is critical.	Provide narrative on importance of maintaining envelope integrity to ensure lab space pressurization requirements are met.	2014-01-08: Add to BOD. 2014-01-08: Add to BOD.
28-1	LEED		Open	13-Mar-13	na	SD set 3/4/13	Project Manual - Fit-Out Systems - Mech	Section A.1: Wet VS Dry lab requirements not defined.	Provide narrative on wet and dry lab design criteria.	2014-01-08: Add to BOD.
35-1	Cx- Process	CxA	In Progr	13-Mar-13	na	SD set 3/4/13	Drawings - Mech	M2.01, Typ Floor plan: Two main Return Air openings per floor. RA openings are prone to cause short-circuiting of lab pressurization.	Consider protecting envelope integrity and providing return air duct. 2014-01-08: See similar item #296. 2014-05-20: No revisions made with RA openings. 2014-06-12: Check installation of walls and review TAB (pre and post).	4/24/13 review: short circuiting of return air paths is possible due to long return air paths and open-ceiling labs. Potential implications for proper conditioning of South-East and South-West offices.
38-1	LEED	Owner	In Progr	13-Mar-13	na	SD set 3/4/13	Jacobs Consultancy Report	Report is referenced. Unable to locate copy on Egnyle web-site.	Provide electronic copy of report or link to shared location. Also refer to Issues #1,2,131.	4/4/13 EHS meeting reviewed a revised report. Request updated copy with approved changes in lab planning requirements. 2014-01-08: Add current version of report to BOD/OPR.
51-1	Design FO	Owner	In Progr	15-Mar-13	na	SD Review Mtg 3/15/2013	O&M Requirements	Shop room requested.	Provide space programming requirements. Examples: data jacks, tables, drawing racks, shelves, etc.	4/24/13 review: No specific requirements provided. 2014-01-08: Shop provided in basement. Space programming not provided. 2014-05-20: KH to check w/ operators. shop room to also serve new EH&S building.

Cx Project Tasks Status										
Equipment	Installation & Startup (by Contr)				Functional Checks (by CxA)					
Equipment Type & ID (Plan Mark)	Submittal	Install / Start-up	IO Checkout	TAB / Verification	IOM Manual Received	IO Verification	Pre- Functional Check (PFC)	Functional Perf. Test (FPT)	GUI Test	System Test
Chilled Water Pump	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Heat Exchanger (W to W)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Expansion Tank (ChW)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Boiler	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Heating Water Pump	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Heat Recovery Pump	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Heat Recovery Coil	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Air Handling Unit	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Split System Fan Coil	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Air-Cooled Condensing Unit	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lab Exhaust Fans	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Toilet Exhaust Fan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cadaver Lab Exhaust Fan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Kitchen Exhaust Fan	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Variable Air Volume Reheat Box	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Supply Air Valve	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
General Exhaust Valve	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hood Exhaust Valve	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Radiators	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unit Heaters	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mechanical Infrastructure	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Building Automation System	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Generator	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Transfer Switch	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lighting Controls	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Domestic Water Heater	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Circulating Pump	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lab Air Compressor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Lab Central Vacuum	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

PROJECT:
PROJECT NO: , R&B: 885-108

MEETING DATE: 10/23/2015, 1:30-2:30pm

LOCATION: Project job trailer

BY: MJB

DISTRIBUTED TO: Owner (D&C): P-, S-

Owner (Facil): P-, S-

Contr: P-, S-

Design: P-, S-

(P-: Primary contact. S-: Secondary contact.)

Item #	Topic	Description	Action Items	Status
	Attendance	Sign-in sheet		New
01-001	Meeting Objectives	- Introduction of CxA - Mobilize Cx effort		New

Process

01-002	Billing	- Coordinate with Casey.		New
01-003	Team Communication	Advise who should be included on Cx correspondence: - Owner reps (D&C): - Owner reps (FE): - Design Team reps: - GC reps: - Other:		New
01-004	Electronic Doc Mgmt	- Design docs - Construction docs		New
01-005	Meetings	- Invites - Minutes - LEED?		New
01-006	Schedules	- Design: planned sets? - Construction: for review (startups, testing, Cx)		New
01-007	Cx Plan	- Design phase: to be developed/coordinated with schedules - Construction phase: to be issued with construction schedule		New

Design

01-008	OPR/BoD	- Use meeting minutes and presentations sent by . - Space requirements matrix (temps, set-points, %RH, vent, FC, standby power, etc) - Other pertinent directives?		New
01-009	Shell & Core review	- Request link to download current Drawings and Specs. - Design details to be furnished how & when?		New
01-010	Fit-out review	- Schedule? Turn-around time required?		New
01-011	Lessons Learned	- Process of incorporating lessons-learned? Documents? - CxA to review lessons-learned and add Cx items.		

Item #	Topic	Description	Action Items	Status
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Construction

01-012	Submittals	- Request copy of submittal log - Identify equipment to be reviewed by CxA - Controls (installation, control sequences, graphics)		New
01-013	Field Observations	- First-ofs - Access for O&M - Participation of Operator?		New
01-014	Mockups	- Terminal equipment & controls - Lighting controls		New
01-015	Installation & startups	- Document QA process of contractor - Verify installation - Witness select startups		New
01-016	PFCs	- Confirmation equipment ready for Cx inspection and Cx testing (distribute FPTs to contractor).		New

Testing

01-017	PFC	- Verification of installation		New
01-018	IO checks.	- For primary and mission-critical equipment - Sampling of other equipment		New
01-019	FPTs	- For primary and mission-critical equipment - Sampling of other equipment		New
01-020	System Tests	- System and building performance; seasonal testing		New
01-021	System Tests	- Other: failure testing of mission critical features?		New

Operation & Occupancy

01-022	Close-out Docs	- As-builts - Record drawings - O&Ms - Warranty plan		New
01-023	Training	- Equipment - Integrated systems/BAS		New
01-024	Quarterly reviews	- Seasonal performance - Warranty review		New
01-025	Reporting	- Cx report - System Manual		New

Issues Log

01-026	Review	- As necessary		New
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New Business

01-027		- Open discussion		New
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Other

	Attachments	- None		New
	Next Meeting	- Schedule as necessary.		New

End of meeting notes

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.
 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

1.6 CLOSEOUT SUBMITTALS

- A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.9 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.
- C. LEED Requirements for Building Reuse:
 - 1. Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.
 - 2. Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be demolished; do not demolish such existing construction beyond indicated limits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- F. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Electrical Systems Requirements:

1. Remove all exposed raceways, exposed and concealed outlet boxes, etc. that are not to be reused where existing walls are to remain. Where new raceways and outlet boxes are shown on existing walls in finished rooms, they shall be installed concealed by cutting and patching method.
2. Reuse existing outlet boxes and raceway systems wherever practical in renovation areas. Install new wiring devices, coverplates, and wiring per applicable specification sections, where such existing outlet boxes are used. Special coverplates may be required to suit conditions.
3. Disconnect and remove, per NEC Articles 770 and 800, exposed feeder, branch circuit, remote control, power limited, non-power limited, and signal line system raceways and their associated circuits and wiring, including wiring for systems and equipment operating at 50 volts or less not installed in raceway rendered inoperable due to removals, relocations and rearrangements. This shall include the complete removal of wiring and cable abandoned by other Divisions, above or below ceilings, as part of this project.
4. Disconnect, remove, rework and otherwise rearrange existing raceways and wiring to accommodate new circuit arrangements indicated and/or required to maintain continuity of existing circuits feeding devices that are to remain.
5. Be responsible for removal and reinstallation of existing electrical equipment to accommodate the work of or disturbed by other trades.
6. In such cases where new circuit breakers or fusible switches are to be added to existing electrical distribution equipment, they shall be of the same manufacturer and design as the existing breakers or fusible switches, except as otherwise noted, and shall be of the sizes as shown on Drawings.
 - a. Be responsible for rearranging any and all existing circuit breakers within the existing equipment, to facilitate the installation of new circuit breakers being added. Provide additional bus, bus extensions, bolts and hardware, enclosure modifications, directory modifications, etc., required to accomplish these modifications.
 - b. Provide new arc-fault signage per Division 26 Sections "Protective Device Coordination" and "Electrical Identification", where changes to the electrical distribution system alter or change the rating, hazard or safety requirements for the room, space, or area.

3.3 PROTECTION

- A. Temporary Facilities:** Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Shoring:** Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

- C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain fire watch during and for at least <Insert number> hours after flame-cutting operations.
 - 6. Maintain adequate ventilation when using cutting torches.
 - 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 10. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."
 - a. Do not bury waste materials from selective demolition activities.
 - b. Do not dispose of waste materials resulting from selective demolition activities into watercourses, storm drainage system, or sanitary sewer system.
 - c. Do not discharge water containing suspended materials into watercourses, storm drainage system, sanitary sewers, or onto adjacent property.
 - 11. Ensure selective demolition operations do not adversely affect adjacent watercourse, groundwater or wildlife and do not contribute to air and noise pollution.
 - 12. Cover or dampen dry materials and waste sufficient to prevent blown dust or debris.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Work in Historic Areas: Selective demolition may be performed only in areas of the Project that are not designated as historic. In historic spaces, areas, and rooms or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Division 01 Section "Historic Treatment Procedures."
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition[and cleaned] and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Luminaires:
 - 1. Disconnect, remove, and store, at the job site, in an indoor dry location, luminaires scheduled for reuse, that have been previously determined to not contain PCB fluorescent ballasts, until such time as they are ready to be reinstalled.
 - a. Existing lamps shall not be reused, regardless of whether or not the existing luminaire is scheduled for reuse. Existing lamps shall be legally disposed of, and reused luminaires shall be relamped with new lamps.
 - 2. Move luminaires that have been previously determined to not contain PCB fluorescent ballasts, and that are scheduled for disconnection and removal, and are not scheduled for reuse or reinstallation, to an on-site location, directed by the Owner. Moved luminaires shall remain the property of the Owner.
 - a. Remove lamps from luminaires, and store separately at an on-site location, directed by the Owner.
 - 3. Remove from the site, and legally dispose of, disconnected and removed luminaires, that have been previously determined to not contain PCB fluorescent ballasts, and that the Owner does not wish to retain.
 - a. Remove lamps from luminaires and dispose of separately.
 - 4. Do not use existing luminaires that have been determined to contain integral or remote mounted PCB fluorescent ballasts, either known, or determined by field survey and investigation.
 - a. Disconnect and remove the PCB containing fluorescent ballast(s), if the ballast(s) is not leaking, per the ballast disposal requirements written herein, and replace with a new non-PCB replacement ballast.
 - b. Notify the project Owner if the PCB containing ballast is leaking, and proceed no further. The luminaire is considered contaminated and hazardous. Removal of the luminaire shall be the responsibility of the Owner.
 - 5. Do not remove or re-use existing luminaires installed in project spaces being abated for asbestos. Luminaires installed in project spaces being abated for asbestos shall be considered hazardous material, and as such shall be removed as part of the abatement process.
 - 6. Do not remove existing luminaires installed in suspended, or other false ceiling spaces below known asbestos containing ceiling cavities. Luminaires installed in such ceiling spaces shall be considered hazardous material, and their removal shall be responsibility of the Owner.
- F. Lamp Disposal:

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1. Fluorescent, mercury vapor, metal halide, high pressure sodium, and neon lamps, contain some amount of the chemical mercury, and as such shall be handled as hazardous waste.
2. Lamp removal and disposal (both mercury containing and low-mercury types) shall be legally disposed of, in accordance with the requirements of the United States Environmental Protection Agency (USEPA) Universal Waste Rule (64 FR 36465-36490), and the state and local level project locale disposal requirements.
3. Remove lamps separately from their respective luminaires, and place (unbroken) into approved, labeled containers.
 - a. Containers may be new cardboard boxes with cardboard lamp sleeves, or discarded cardboard boxes from new lamps with the lamp spacers left intact.
4. The total weight for all on-site, project related, disposed lamp containers, cannot exceed 500 lbs. at any one time. The containers shall be removed from the project site, delivered or picked-up by a licensed lamp recycler, and legally disposed of, within 1 year of lamp removal.

G. Fluorescent Lamp Ballast Disposal:

1. Dispose of ballasts identified or labeled "NON-PCB", "NO PCB", or similar marking, (indicating that the ballast does not contain PCB), as ordinary construction waste.
2. Ballasts not identified or labeled "NON-PCB", "NO PCB", or similar marking (indicating that the ballast does not contain PCB), shall be presumed to be PCB containing, and shall be handled as hazardous waste.
3. Remove non-leaking ballasts containing PCB, or presumed to be containing PCB, from their respective luminaires.
 - a. Provide protective gloves, eye protection, and protective clothing, for the person(s) removing ballasts.
 - b. Place removed ballasts in contractor provided 55 or 30 gallon, US DOT approved, type 17C, or 17H drums (barrels). The quantity and size of the drums shall be determined by the Contractor.
 - c. Provide approved PCB absorbent materials placed and stored immediately adjacent to the drum storage area. Do not place loose absorbent material inside the drums.
 - d. Label and mark the PCB ballast storage drums with EPA approved PCB labels, and provide the appropriate warning signs, markings, and clearance lines, to meet the federal, state, and local hazardous materials handling regulations.
 - e. Place barrels containing removed PCB containing ballasts at an on-site, indoor storage location, sealed with the cover that came with the barrels. Barrels shall not be placed outside exposed to weather.
 - f. Provide to the Project representative, in written form, the total count of the ballasts removed (or their total weight by barrel), and where they are stored.
 - g. Barrels containing removed PCB ballasts shall not to be removed from the work site by the Contractor. To do so, would be a violation of DOT hazardous waste regulations and may result in a fine. Provide for the services of an authorized hazardous waste hauler to remove and deliver the ballasts to an authorized recycler, or PCB incinerator facility.
4. Do not remove ballasts containing PCB, or presumed to be containing PCB, that are visibly showing signs of leakage (evidenced by potting compound leakage or by an oily film on the ballast surface), from their respective luminaire. The entire luminaire shall be presumed to be contaminated, and shall be handled as a hazardous material.
 - a. Notify the project Owner, and proceed no further. Removal of the luminaire shall be the responsibility of the Owner.

H. Wire and Cable:

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1. Disconnect and remove, per NEC Articles 770 and 800, exposed feeder, branch circuit, remote control, power limited, non-power limited, and signal line system raceways and their associated circuits and wiring, including wiring for systems and equipment operating at 50 volts or less not installed in raceway rendered inoperable due to removals, relocations and rearrangements. This shall include the complete removal of wiring and cable abandoned by other Divisions, above or below ceilings, as part of this project.

I. Smoke Detectors:

1. Remove existing ionization type smoke detectors (that the Owner does not wish to keep) from the project site, delivered to either a licensed and certified recycling provider, or to the original equipment manufacturer, for recycling and their disposal. Landfill disposal or construction waste disposal of ionization type smoke detectors is not permitted.
 - a. Dispose of photoelectric type smoke detectors as ordinary waste.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Laboratory Test Reports: For liquid floor treatments and curing and sealing compounds, indicating compliance with requirements for low-emitting materials.
- C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- D. 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.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Location of construction joints is subject to approval of the Architect.
- F. Samples: For waterstops, vapor retarder.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer, manufacturer, and testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Waterstops.
 6. Curing compounds.
 7. Floor and slab treatments.
 8. Bonding agents.
 9. Adhesives.
 10. Vapor retarders.
 11. Semirigid joint filler.
 12. Joint-filler strips.
 13. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency:
1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

- F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- G. Field quality-control reports.
- H. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.
- E. Mockups: Cast concrete formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Build panel approximately 100 sq. ft. (9.3 sq. m) for formed surface in the location indicated or, if not indicated, as directed by Architect.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.10 FIELD CONDITIONS

- A. 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 average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

3. Overlaid Finnish birch plywood.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

- G. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- D. Steel Bar Mats: ASTM A 184/A 184M, fabricated from [ASTM A 615/A 615M, Grade 60 (Grade 420)] [ASTM A 706/A 706M], deformed bars, assembled with clips.
- E. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- F. Deformed-Steel Wire: ASTM A 1064/A 1064M.
- G. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 500 miles (800 km) of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. Regional Materials: Concrete shall be manufactured within 500 miles (800 km) of Project site.

- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- D. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
 - 2. Fly Ash: ASTM C 618, Class F or C.
 - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 - 4. Silica Fume: ASTM C 1240, amorphous silica.
- E. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- F. Air-Entraining Admixture: ASTM C 260/C 260M.
- G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and 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 C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- H. 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.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. BASF Corporation; Construction Systems; MasterLife CI 222 (Pre-2014: Rheocrete 222+).
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn.; DCI-S.
 - c. Sika Corporation; FerroGard 901.
- I. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. Sika Greenstreak.
 - b. Williams Products, Inc.
 2. Profile: Flat dumbbell with center bulb, Ribbed with center bulb, and Ribbed without center bulb as indicated and as suits individual applications.
 3. Dimensions: 6 inches by 3/8 inch thick (150 mm by 10 mm thick); nontapered.
- B. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BoMetals, Inc.
 - b. Sika Greenstreak; Sika Greenstreak PVC Waterstop.
 - c. Vinylex Waterstop & Accessories.
 2. Profile: Ribbed with center bulb or as indicated.
 3. Dimensions: 6 inches by 3/8 inch thick (150 mm by 10 mm thick); nontapered.
- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
1. 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]:
 - a. Carlisle Coatings & Waterproofing Inc; MiraSTOP.
 - b. JP Specialties, Inc.; Earth Shield Type 20.
 - c. Sika Greenstreak; Swellstop.
- D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal MC-2005T.
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Adcor ES.
 - c. Sika Greenstreak; Hydrotite.
- 2.7 VAPOR RETARDERS
- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Reef Industries, Inc; [Griffolyn 15 mil Green].
 - b. Stego Industries, LLC; Stego Wrap 15 mil Class A.
 - c. W. R. Meadows, Inc; Perminator 15 mil.

2.8 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch (9.5-mm) sieve.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc; A-H Emery Non-Slip.
 - b. Dayton Superior; Emery Non-Slip.
 - c. Metalcrete Industries; Met-Top E.
- B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anti-Hydro International, Inc; A-H Alox.
 - b. BASF Corporation; Construction Systems; MasterTop 120 SR (Pre-2014: Frictex NS).
 - c. L&M Construction Chemicals, Inc; Grip It AO.
- C. Emery Dry-Shake Floor Hardener: Pigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. BASF Corporation; Construction Systems; Confilm.
 - b. Dayton Superior; AquaFilm Concentrate J74.
 - c. Euclid Chemical Company (The); an RPM company; Eucobar.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. BASF Corporation; Construction Systems; MasterKure CC 160 WB (Pre-2014: Kure N Seal WB).

- b. Dayton Superior; Clear Cure VOC J7WB.
 - c. Euclid Chemical Company (The); an RPM company; Kurez DR VOX.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. BASF Corporation; Construction Systems.
 - b. Dayton Superior; Cure & Seal 1315 EF.
 - c. Euclid Chemical Company (The); an RPM company; Super Diamond Clear VOX.
 - 2. Products shall comply with the 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."

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 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 according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Slag Cement: 25 percent.
 - 4. Combined Fly Ash or Pozzolan and Slag Cement: 25 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, Slag Cement, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.45.

3. Slump Limit: 4 inches (100 mm) 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
- B. Foundation Walls: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 2. Maximum W/C Ratio: 0.45.
 3. Slump Limit: 4 inches (100 mm) 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
- C. Slabs-on-Grade: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 2. Maximum W/C Ratio: 0.45.
 3. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
 4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
 6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- D. Suspended Slabs: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 2. Maximum W/C Ratio: 0.45.
 3. Minimum Cementitious Materials Content: 520 lb/cu. yd. (309 kg/cu. m).
 4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
 6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- E. Concrete Toppings: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 2. Minimum Cementitious Materials Content: 540 lb/cu. yd. (320 kg/cu. m).
 3. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
 5. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.
- F. Building Frame Members: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi (27.6 MPa) [As indicated] at 28 days.
 2. Maximum W/C Ratio: 0.45.
 3. Slump Limit: 4 inches (100 mm) 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).

4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

G. Building Walls: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) [As indicated] at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm) 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture <Insert dimension>, plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

2.14 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 2. 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. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

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

3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.6 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.
- G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780/A 780M. Use galvanized-steel wire ties to fasten zinc-coated steel reinforcement.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls [as indicated] <Insert spacing>. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch (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: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOP INSTALLATION

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

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
 - D. 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. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 - E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- 3.10 FINISHING FORMED SURFACES
- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces not exposed to public view.
 - B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. 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.
 - C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine

sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 1. Apply scratch finish to surfaces indicated, to receive concrete floor toppings, and to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces indicated, to 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: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces indicated, 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.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
 - a. 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; for slabs-on-grade.
 - b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
 3. Finish and measure surface, so gap at any point between concrete surface and an unveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and

placed anywhere on the surface does not exceed [1/4 inch (6 mm)] [3/16 inch (4.8 mm)] [1/8 inch (3.2 mm)].

- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated, and 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.
 - 1. 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 elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
 - 1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate or aluminum granules over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 - 2. After broadcasting and tamping, apply float finish.
 - 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. 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 4 inches (100 mm) high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) 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. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Cast anchor-bolt insert into bases. 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. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING 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 ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 1. Defer joint filling until concrete has aged at least [one] [six] month(s). 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. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. 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. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 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.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to 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 C 143/C 143M; 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. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; 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.
5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. 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.
7. 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.
8. 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).
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. 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.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

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- E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

END OF SECTION 033000

SECTION 033500 - CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Polished concrete floors and precast concrete treads.

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 "Specification for Structural Concrete for Buildings."
2. ACI 302.1R Guide for Concrete Floor and Slab Construction.
3. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete."
4. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete."
5. ACI 305R "Recommended Practice for Hot Weather Concreting."
6. ACI 306R "Recommended Practice for Cold Weather Concreting."

B. ASTM International:

1. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
2. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.
3. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
4. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meetings: Conduct a pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 01 Section Project Management and Coordination. Review the following:

1. Environmental requirements.
2. Scheduling and phasing of work.
3. Coordinating with other work and personnel.
4. Protection of adjacent surfaces.
5. Surface preparation.
6. Floor flatness and levelness.
7. Repair of defects and defective work prior to installation.
8. Cleaning.
9. Installation of polished floor finishes.
10. Application of liquid hardener, densifier.
11. Protection of finished surfaces after installation.

B. Scheduling: Comply with finishing material manufacturer's ordering instructions and lead time requirements to avoid construction delays.

1.4 ACTION SUBMITTALS

A. Product Data: Submit product data, including manufacturer's product sheet, for specified products.

1. Include preparation and concrete grinding procedures and colored concrete surface.

B. Shop Drawings:

1. Polished Concrete.
 - a. Layout of contraction joints to be cut into the slab.
 - b. Typical layout including dimensions and floor grinding schedule.
 - c. Plan view of floor and joint pattern layout.
 - d. Hardener, sealer, densifier in notes.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Instructions: Manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

- A. Warranty: Submit warranty documents specified in this Section.
- B. Operation and Maintenance Data: Submit operation and maintenance data for installed products in accordance with Division 01 Section Project Closeout.
1. Manufacturer's instructions on maintenance renewal of applied treatments.
 2. Protocols and product specifications for joint filing, crack repair and/or surface repair.

1.7 QUALITY ASSURANCE

- A. Single Source: Provide each type of concrete finishing components and materials from single manufacturer
- B. Mock-Ups:
1. Polished Concrete: At a location on the Project site as directed by Architect and under conditions similar to those which will exist during actual placement, construct a 100 sq. ft. (9.3 sq. m) sample panel mock-up including interface of finishing with adjacent construction.
 - a. Mock-up will be used to evaluate workmanship, concrete substrate preparation, operation of equipment, material application, color selection and similar characteristics.
 - b. When accepted, mock-up will demonstrate minimum standard of quality required for this work.
 - c. Remove mock-up and dispose of materials when no longer required and when directed by Architect.

1.8 DELIVERY, STORAGE & HANDLING

- A. Delivery: Deliver materials in manufacturer's original packaging with identification labels and seals intact.
- B. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer. Protect concrete slab prior to and after finishing.
1. Diaper hydraulic power equipment.
 2. Restrict vehicular parking.
 3. Restrict use of pipe cutting machinery.
 4. Restrict placement of reinforcing steel on slab.
 5. Restrict use of acids or acidic detergents on slab.

PART 2 - PRODUCTS

2.1 POLISHED CONCRETE FINISHING PRODUCTS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products specified in this article by L.M. Scofield Company or an acceptable comparable product.
- B. System Requirements
 - 1. Design Requirements:
 - a. Hardened Concrete Properties: Normal weight concrete without lightweight aggregate, non-air entrained, with minimum 3500 psi (24 MPa) concrete compressive strength.
 - b. Placement Properties: Natural concrete slump of 4-1/2 to 5 inches (114 to 127 mm) and complying with the following flatness requirements:
 - 1) Overall FF 40.
 - 2) Local FF 27.
 - c. Hard-Steel Troweled (3 pass) Concrete: No burn marks. Finish to ACI 302.1R, Class 5 floor.
 - d. Curing Options:
 - 1) Sheet membrane (ASTM C171); polyethylene film not acceptable.
 - 2) Damp Curing: Seven day cure.
 - 2. Materials
 - a. Hardener, Sealer, Densifier: Water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
 - 1) Basis-of-Design Material: "Formula One Lithium Densifier MP" by L.M. Scofield Company.
 - b. Sealer: Ready to use, lithium silicate oil and water repellent, VOC compliant and compatible with chemically hardened floors.
 - 1) Basis-of-Design Material: "Formula One Guard-W" by L.M. Scofield Company.
 - c. Finish: Standard Medium gloss (MG-2), 800 grit.
 - 1) Finish: Grade 1, light sand finish.
 - d. Temporary Floor Protection: "Proguard Duracover" by L. M. Scofield Company.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify that concrete substrate is acceptable for installation of concrete finishing materials in accordance with product manufacturer's instructions prior to beginning installation of concrete finishing materials.
- B. Concrete Slab Performance Requirements for Polished Concrete: Verify concrete is cured to 28 day 3500 psi (24 MPa) strength and that concrete surfaces received a hard steel-trowel finish (3 passes) during placement.

3.2 PREPARATION

- A. Provide contraction joints as indicated in approved shop drawings, not to exceed 30 square feet.

- B. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials. Remove surface contamination.
- C. Examine surface to determine soundness of concrete for polishing application.

3.3 INSTALLATION

- A. Comply with concrete finishing material manufacturer's application and installation instructions and recommendations.
- B. Concrete:
 - 1. Provide polished concrete floor treatment to concrete slab as indicated on Drawings, providing consistent finish in all contiguous areas.
 - 2. Apply floor finish prior to installation of fixtures and accessories.
 - 3. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit using dry method unless otherwise recommended by floor finish manufacturer.
 - a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level.
 - b. Match level of sheen and expose aggregate in concrete surface in accordance with approved mock-up.
 - c. Ensure all concrete surfaces are uniform in appearance.
 - 4. Apply hardener and densifier in accordance with recommendations of polished concrete floor finishing product manufacturer.
 - 5. Remove defects and repolish defective areas.
 - 6. Finish edges of floor finish adjoining other materials in a clean and sharp manner.
 - 7. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.
 - 8. Fill joints flush to surface.

3.4 PROTECTION

- A. Protect finished concrete from damage during construction in accordance concrete finishing product manufacturer's recommendations.

END OF SECTION 033500

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Brick units.
 - a. Clay face brick.
 - 2. Mortar and grout materials.
 - 3. Reinforcement.
 - a. Masonry joint reinforcement.
 - 4. Ties and anchors.
 - 5. Embedded flashing materials, coordinate with Division 07 Section "Sheet Metal Flashing and Trim."
 - 6. Miscellaneous masonry accessories.
 - 7. ***Non-Load bearing concrete masonry units (CMU's) (BP #3)***
- B. Products Installed but not Furnished under This Section:
 - 1. Steel lintels in unit masonry.
 - 2. Steel shelf angles for supporting unit masonry.
 - 3. Cavity wall insulation.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
 - 1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
- C. Shop Drawings: For the following:
 - 1. Special Brick Shapes: Provide minimum 1/2 inch = 1 foot drawings indicating special shapes prior to fabrication.
 - 2. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
 - 4. ***Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls. (BP #3)***
- D. Samples for Verification: For each type and color of the following:
 - 1. concrete masonry units.
 - 2. Clay face brick, in the form of straps of five or more bricks.
 - 3. Special brick shapes.
 - 4. mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 - 5. Weep vents.

1.3 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. For exposed brick, include test report for efflorescence according to ASTM C 67.
 - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 3. Preblended dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Joint reinforcement.
 - 5. Anchors, ties, and metal accessories.

1.4 QUALITY ASSURANCE

- A. Sample Panels: **Construct sample panels in accordance with Division 01 Section "Quality Assurance."** ~~Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.~~
 - 1. ~~Build sample panels for each type of exposed unit masonry construction in sizes approximately 60 inches (1500 mm) long by 48 inches (1200 mm) high by full thickness, including insulation, AVB, sheathing and studs.~~
 - 2. ~~Build sample panels facing south.~~
 - 3. ~~Clean one half of exposed faces of panels with masonry cleaner indicated.~~
 - 4. ~~Protect approved sample panels from the elements with weather-resistant membrane.~~
 - 5. ~~Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.~~
 - a. ~~Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing. ADD 1-1~~
- B. Mockups: **Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance." Test mockups in accordance with Division 08 Section "Structural Sealant Glazed Curtainwall."** ~~Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.~~
 - 1. ~~Build mockups for typical exterior wall in sizes approximately 96 inches (2400 mm) wide by long by (72 inches) (1800 mm) high by full thickness, including face and backup wythes and accessories.~~
 - a. ~~Include a sealant-filled joint at least 16 inches (400 mm) long in exterior wall mockup.~~
 - b. ~~Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.~~

- ~~c. — 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).~~
- ~~d. — Include metal studs, sheathing, water-resistive barrier, sheathing joint and penetration treatment, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry veneer wall mockup.~~
- ~~e. — Include window opening.~~
- ~~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 such deviations are specifically approved by Architect in writing.~~
- ~~4. — Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion. ADD 1-1~~

1.5 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. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT 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 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 (3) 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 ACI 530.1/ASCE 6/TMS 602.
- E. 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. 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 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry and will be within 20 feet (6 m) vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to Authorities Having Jurisdiction.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 BRICK

- A. Regional Materials: Brick shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. General: Provide shapes indicated and as follows:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where:
 - a. Provide special shapes in dimensions coordinated with base bid and alternates to accommodate geometry indicated on plan drawings without mitered masonry joints and maintain bond pattern. Refer to section details on drawings and as indicated below.
 - b. Stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

- c. Requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
- d. Shapes produced by sawing would result in sawed surfaces being exposed to view.
- e. Lintel/shelf angle lip brick; used at all shelf angles and loose lintels.
- f. Lintel/shelf angle brick left corners; used at all shelf angles.
- g. Lintel/shelf angle brick right corners; used at all shelf angles.
- h. Solid brick at top of wall as indicated on drawings.

C. Clay Face Brick:

- 1. Basis of Design Brick Type #1: ASTM C-216, Grade SW, Type FBS.
 - a. Ragland Clay Products, LLC - Architectural Line - Full Range Select Smooth.
 - b. Size: Modular
 - c. Bond Pattern: Running bond.
 - d. Mortar:
 - 1) Batch plant mixed colored mortar ~~with integral water repellent~~. **ADD 1-1**
 - 2) Color: custom color to match red brick.
 - 3) Type: N.

2.4 MORTAR AND GROUT

- A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- B. Portland Cement: ASTM C 150, 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.
- C. Hydrated Lime: ASTM C 207, Type S.
- D. Mortar Cement: ASTM C 1329.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Solomon Colors, Inc.; SGS Mortar Colors.
- 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.
- G. Water: Potable.
- H. Aggregate for Grout: ASTM C 404. (BP #3)**

2.5 REINFORCEMENT

- A. Engineered Masonry Reinforcement: Provide engineered reinforcement where dimension from back of face brick to face of CMU **or face of stud walls** exceed 4-1/2 inches.

1. Delegated Design: Design engineered masonry reinforcement by comprehensive engineering analysis by qualified professional engineer registered in the state where the Project is located using performance requirements and design criteria indicated.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 1. Exterior Walls: Hot-dip galvanized carbon.
 2. Interior Walls: Hot-dip galvanized, carbon steel. (BP #3)
- ~~C. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry Veneer Anchors: Single 0.187-inch (4.76 mm) diameter, hot-dip galvanized carbon steel continuous wire. ADD 1-1~~
- D. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420). (BP #3)
- E. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated. (BP #3)
 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. (BP #3)
- F. Masonry Joint Reinforcement for Single-Wythe Masonry: Ladder with single pair of side rods. (BP #3)
- G. Reinforcement Fabrication: Fabricate bars used in masonry reinforcement in accordance with the fabricating tolerances of ACI 315. (BP #3)
 1. Unless otherwise required, bend bars cold; do not heat bars.
 2. Minimum Inside Diameter of Bend for Stirrups: 5 bar diameters.
 - a. Do not bend Grade 40 bars in excess of 180 degrees. (BP #3)
 3. Minimum Inside Bend Diameter for Other Bars:
 - a. No. 3 through No. 8 (M#10 through 25): 6 bar diameters.
 - b. No. 9 through No. 11 (M#29 through 36): 8 bar diameters. (BP #3)
 4. Provide standard hooks that conform to the following:
 - a. 180-Degree Hook: 180-degree bend plus minimum extension of 4 bar diameters or 2-1/2 inches (64 mm) whichever is greater.
 - b. 135-Degree Hook: 135 -degree bend plus minimum extension of 6 bar diameters or 4 inches (102 mm) whichever is greater.
 - c. 90-Degree Hook: 90-degree bend plus minimum extension of 12 bar diameters.
 - d. For stirrups: a 90 degree or 135 degree bend plus a minimum of 6 bar diameters or 2-1/2 in. (64 mm) whichever is greater. (BP #3)
 5. Fabricate joint reinforcement, anchors, and ties in accordance with requirements specified in this Section and with published specifications of accepted manufacturer. (BP #3)

2.6 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.
- Wire Ties: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- B. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
- Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
 - Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
 - Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Adjustable Masonry-Veneer Anchors
- General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
 - Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
 - ~~**Seismic Masonry Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in the veneer mortar joint.**~~
 - ~~**Products: Subject to compliance with requirements, provide the following:**~~
 - ~~**Hohmann & Barnard, Inc.; DW-10-X Seismiclip.**~~
 - ~~**Anchor Section: Gasketed sheet metal plate, 1 1/4 inches (32 mm) wide by 6 inches (150 mm) long, with screw holes top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch (16 mm) wide by 6 inches (150 mm) long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.**~~
 - ~~**Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire. Size wire tie to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face.**~~
 - ~~**Fabricate sheet metal anchor sections and other sheet metal parts from 0.097-inch (2.5 mm) thick, steel sheet, galvanized after fabrication.**~~
 - ~~**Fabricate wire connector sections from 0.188-inch (4.8 mm) diameter, hot-dip galvanized, carbon steel wire. ADD 1-1**~~
 - Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.**
 - Products: Subject to compliance with requirements, provide one of the following:**
 - Heckmann Building Products Inc.; Pos-I-Tie.**

- 2) *Hohmann & Barnard, Inc.; 2-Seal Tie with Byna-Lok Wire Tie.*
- 3) *Wire-Bond; SureTie*

- b. *Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit insulation and sheathing thickness.*
- c. *Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.25-inch-diameter, hot-dip galvanized steel wire. ADD 1-1*

- D. *Partition Top anchors: 0.105-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches 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. (BP #3)*

2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual " and as follows:
 - 1. Stainless Steel: ASTM A 666, Type 304, 0.016 inch (0.4 mm) thick.
 - 2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.6 m). Provide splice plates at joints of formed, smooth metal flashing.
 - 3. Fabricate through-wall flashing with 1/4 inch drip edge, unless otherwise indicated.
 - 4. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.
 - 5. Provide shop-fabricated and soldered inside and outside corners.
- B. Solder and Sealants for Sheet Metal Flashings:
 - 1. Solder for Stainless Steel: ASTM B 32, Grade Sn50, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- C. 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.

2.8 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, urethane or PVC.
- B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- C. Weep/Vent Products: Use the following, unless otherwise indicated:
 - 1. Polyester Mesh: 90% open, non-woven polyester mesh to fill open head joints at the base and head of the wall.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) CavClear: Weep Vents.
 - 2) Mortar Net: WeepVent.
- D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep that prevent mesh from being clogged with mortar droppings.
2. Products: Subject to compliance with requirements, provide the following:
 - a. Mortar Net Solutions; Mortar Net.

E. *Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated. (BP #3)*

2.9 CAVITY-WALL INSULATION

A. ~~Extruded Polystyrene Board Insulation with Increased R-Value: ASTM C 578, Type IV, but with an aged thermal resistance (R-value) for 1-inch thickness of 5.6 deg F x h x sq. ft./Btu at 75 deg F at 5 years; closed-cell product with a carbon black filler and extruded with an integral skin. ADD 1-5~~

B. *Polyisocyanurate Board Insulation: ASTM C 1289.*

1. ~~Provide high impact styrene drainage panels with non-woven drainage fabric bonded to exterior face. ADD 1-6~~

- a. Products: Subject to compliance with requirements, provide the following:
 - 1) Hunter Xci CG panels.

2. *Adhesive: Type recommended by insulation board manufacturer for application indicated. ADD 1-5*

2.10 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. For exterior masonry and reinforced masonry, use portland cement-lime.
- 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 or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type S.
 2. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 3. ~~For interior non-load-bearing partitions, Type O may be used instead of Type N. ADD 1-1~~**
- D. Grout for Unit Masonry:** Comply with ASTM C476.

1. *Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.*
2. *Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 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 (203 to 279 mm) as measured according to ASTM C 143/C 143M. (BP #3)*

2.11 CONCRETE MASONRY UNITS (CMUs)

- A. *Regional Materials: CMUs shall be manufactured within 500 miles (800 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.*
- B. *Non-Load-Bearing CMUs: ASTM C 129.*
 1. *Density Classification: Lightweight.*
 2. *Size: 7-5/8-inches by 7-5/8-inches by 15-5/8-inches (162 by 162 by 365 mm).*
 3. *Exposed Faces: Provide manufacturer's standard color and texture suitable for paint finish. (BP #3)*
- C.

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 work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. 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.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
 1. Mix units from several pallets or cubes as they are placed.

- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements - Maximum Variation:

1. Dimensions in Cross Section or Elevation: Plus 1/2-inch (12 mm) or minus 1/4-inch (6 mm).
2. Location of Elements in Plan - From That Indicated: Plus or minus 1/2-inch (12 mm) or plus 3/4-inch (19 mm) maximum.
3. Location of Elements in Elevation - From That Indicated: Plus or minus 1/4-inch (6 mm) in a story height or 3/4-inch (19 mm) total.
4. Grout Space or Cavity Width: Plus 3/8-inch (9.5 mm) or minus 1/4-inch (6 mm).

B. Lines and Levels - Maximum Variation:

1. Bed Joints and Top Surfaces of Bearing Walls - From Level: 1/4-inch in 10 feet (6 mm in 3 m), or 1/2-inch (12 mm) maximum.
2. Conspicuous Horizontal Lines (such as lintels, sills, parapets, and reveals) From Level: 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. Vertical Lines and Surfaces - From Plumb: 1/4-inch in 10 feet (6 mm in 3 m), (3/8-inch) (9.5 mm) (in 20 feet) (9 mm in 6 m), or 1/2-inch (12 mm) maximum.
4. Conspicuous Vertical Lines (such as external corners, door jambs, reveals, and expansion and control joints) - From Plumb: 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. Lines and Surfaces - From Straight: 1/4-inch in 10 feet (6 mm in 3 m), (3/8-inch) (9.5 mm) (in 20 feet) (9 mm in 6 m), or 1/2-inch (12 mm) maximum.
6. Vertical Alignment of Exposed Head Joints - From Plumb: 1/4-inch in 10 feet (6 mm in 3 m), or 1/2-inch (12 mm) maximum.
7. Faces of Adjacent Exposed Masonry Units - From Flush Alignment: 1/16-inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
8. Alignment of Columns and Walls (Bottom Versus Top): 1/2-inch (12 mm) for bearing walls and 3/4-inch (19 mm) for non-bearing walls.

C. Joints - Maximum Variation:

1. Bed Joints - From Thickness Indicated: Plus or minus 1/8-inch (3 mm), with a maximum thickness limited to 1/2-inch (12 mm).
2. Exposed Bed Joints - From Bed-Joint Thickness of Adjacent Courses: 1/8-inch (3 mm).
3. Head and Collar Joints - From Thickness Indicated: Plus 3/8-inch (9 mm) or minus 1/4-inch (6 mm).
4. Exposed Head Joints - From Thickness Indicated: Plus or minus 1/8-inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8-inch (3 mm).
5. Exposed Bed Joints and Head Joints of Stacked Bond - From a Straight Line: 1/16-inch (1.5 mm) from one masonry unit to the next.

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 racking 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. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. ***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. (BP #3)***

3.5 MORTAR BEDDING AND JOINTING

- A. Lay solid masonry units 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.
- B. Set trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Wet joint surfaces thoroughly before applying mortar.
 - 3. Rake out mortar joints for pointing with sealant.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
 - 1. Individual Metal Ties: Provide ties as shown installed in horizontal joints as follow unless otherwise required to suit coursing or to comply with requirements of authorities having jurisdiction and applicable building codes. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - a. Adjustable 2-Piece Ties: One metal tie for 1.77 sq. ft. (0.16 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically.

- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with ~~seismic~~ masonry-veneer anchors to comply with the following requirements: **ADD 1-1**
 - 1. Fasten screw-attached ~~and seismic~~ anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener. **ADD 1-1**
 - 2. Embed connector sections and continuous wire in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 18 inches (458 mm) o.c. vertically and 24 inches (610 mm) o.c. horizontally, with not less than one anchor for each 2 sq. ft. (0.2 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.
- B. Provide not less than 1-1/4 inch (25 mm) of airspace between back of masonry veneer and face of insulation.
 - 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion 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 using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 - 3. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick as follows:
 - 1. Build in compressible joint fillers where indicated.
 - 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch (10 mm).

3.9 LINTELS

- A. Install steel lintels where indicated. Refer to Section 055000 "Metal Fabrications" for steel lintels.

3.10 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Flashing: 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 and joints in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of substrate at least 8 inches (200 mm); with upper edge tucked in reglet and under air barrier lapping at least 4 inches (100 mm). Deform horizontal portion of through wall flashing with ball peen hammer prior to setting brick
 - 3. At lintels and shelf angles, 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 2-1/2 inches (50 mm) to form end dams.
 - 4. 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. **ADD 1-1**
 - 5. Extend flashing to 1/4 inch beyond face of brick.
 - 6. Lap flashing a minimum of 6 inches and bed lap in five beads of sealant installed parallel to the lap joint.
- 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/vent products to form weep holes.
 - 2. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting:

1. **~~Owner-Contractor~~** will engage qualified, independent special inspectors and testing agency 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. **ADD 1-1**
 2. Refer to "Testing Agency Qualifications" in "Quality Assurance" article in Part 1 - General above for testing agency requirements.
 3. **Refer to "Field Quality Control" in Division 08 Section "Structural Sealant Glazed Curtainwalls" for testing requirements and areas to be tested on the building.**
 4. **Contractor to test all flashing laps and end dams by placing a glazing putty containment wall around the flashing seam and filling it with water for a two hour duration. If no leaks occur, brick installation may proceed. ADD 1-1**
- B. Inspections: Level 1 and Level 2 special inspections according to the "International Building Code."
1. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 2. Place grout only after inspectors have verified proportions of site-prepared grout.
 3. Testing Prior to Construction: One set of tests.
- C. Inspections: Special inspections according to Level [B] [C] 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.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- 3.12 REPAIRING, POINTING, AND CLEANING
- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. Air Barriers: Repair any damage to air barriers resulting from masonry construction at no additional cost to Owner in compliance with following requirements:
1. Seal penetrations in air barrier created by screws or other fasteners used to secure veneer in accordance with recommendations of air barrier manufacturer and as directed by air barrier installer. Provide all repair work necessary and as required to ensure continuance of applicable warranties for the air barrier.
 2. Seal holes or tears in air barrier resulting from masonry construction in accordance with the instructions and recommendations of air barrier installer and air barrier manufacturer. Provide all repair work necessary and as required to ensure continuance of applicable warranties for the air barrier.
 3. Test repairs to air barrier for air tightness and water tightness to ensure repaired air barrier complies with requirements specified in applicable air barrier technical sections. Submit field test reports to Architect.

- a. Repeat testing and additional repair efforts until testing results are acceptable and demonstrate compliance with specified requirements for air barrier. Do not proceed with additional masonry construction until repair and testing of repaired air barrier demonstrate compliance with specified air barrier requirements.
- 4. Prior to beginning masonry construction, obtain inspection by air barrier manufacturer of proposed construction and field conditions and obtain letter of acceptance from air barrier manufacturer, submitting copy of letter to Architect.
- D. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- E. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Do not dispose of masonry waste as fill within (450 mm) of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 044300 - ANCHORED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stone masonry anchored to concrete backup.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.

- B. Shop Drawings: Show fabrication and installation details for dimension stone assembly, including dimensions, layout, and profiles of stone units.

1. Show locations and details of joints both within dimension stone assembly and between dimension stone assembly and other construction.
2. Show locations and details of anchors, attachment, and backup structure.

C. LEED Submittals:

1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.

D. Samples for Verification:

1. For each stone type indicated. Include at least two Samples in each set and show the full range of color and other visual characteristics in completed Work.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports:

1. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

- B. Mockups: **Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance." Test mockups in accordance with Division 08 Section "Structural Sealant Glazed Curtainwall."** ~~Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.~~

1. **Build mockup of typical wall area as shown on Drawings.**
2. **Protect accepted mockups from the elements with weather-resistant membrane.**
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.**

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the wall surface.
 - 2. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
- C. 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 stone masonry damaged by frost or freezing conditions. 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 masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.8 COORDINATION

- A. Advise installers of other work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain stone, from single quarry with resources to provide materials of consistent quality in appearance and physical properties.

2.2 GRANITE

- A. Material Standard: Comply with ASTM C 615.
- B. Regional Materials: Granite shall be fabricated within 500 miles of Project site from stone that has been extracted within 500 miles of Project site.
- C. Description: Uniform, medium-grained, black stone without veining.
- D. Varieties and Sources: Subject to compliance with requirements, provide the following:
 - 1. Cold Spring Mesabi Black, honed finish.
- E. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.3 STONE TRIM ANCHORS

- A. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or postinstalled anchor bolts for fastening to substrates or framing as indicated. Provide anchors and supports sufficient to carry load of stone indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Heckmann Building Products Inc.
 - b. Hohmann & Barnard, Inc.
- B. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M or ASTM A 666, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.
- C. Fasteners for Stone Trim Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Postinstalled Anchor Bolts for Fastening Stone Trim Anchors: Chemical anchors or torque-controlled expansion anchors made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or Type 316, for anchors.

2.4 MISCELLANEOUS MASONRY ACCESSORIES

- A. Asphalt Dampproofing: Refer to Division 07 Section "Bituminous Dampproofing".
- B. Sealants: Refer to Division 07 Section "Joint Sealants".

2.5 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
 - 1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
- B. Cut stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.
- C. Cut and drill sinkages and holes in stone for anchors and supports.
- D. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - 1. Clean sawed backs of stone to remove rust stains and iron particles.
- E. Thickness of Stone: Provide thickness indicated
- F. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockups.
 - 1. Finish: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
- B. Coat non-visible portions of stone with asphalt damproofing.

3.3 SETTING STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
 - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- B. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.
- D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.
- E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

- A. Anchor stone masonry to concrete with stainless steel anchors unless otherwise indicated. Secure anchors by mechanically or chemically attaching to concrete.
- B. Space anchors to provide not less than one anchor per 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches and as required to support stone load.
- C. Anchor stone trim with stone trim anchors where indicated. Install anchors by fastening to substrate and inserting tabs and dowels into kerfs and holes in stone units. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with non-staining silicone sealant.

3.6 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 - 2. Defective joints.
 - 3. Stone masonry not matching approved samples and mockups.
 - 4. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

3.7 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in greatest dimension.
 - 2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044300

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SECTION 051200 - STRUCTURAL STEEL FRAMING

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. Structural steel.
- 2. Field-installed shear connectors.
- 3. Grout.

B. Related Requirements:

- 1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
- 2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
- 3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for surface-preparation and priming requirements.
- 4. Section 133419 "Metal Building Systems" for structural steel.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- D. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 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 anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. 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.
 - 5. Identify members and connections of the Seismic-Load-Resisting System.
 - 6. Indicate locations and dimensions of protected zones.
 - 7. Identify demand critical welds.
- D. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Structural-steel connection analysis and signed and sealed calculations are required to be completed and submitted prior to structural steel shop drawing submittal. Structural steel shop drawings are considered incomplete without prior submittal of sealed connection designs. Information included in the sealed connection submittal are required to be incorporated in the steel shop drawings for the steel shop drawings to be considered complete.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, and testing agency.
- B. Welding certificates.
- C. Mill test reports for structural steel, including chemical and physical properties.
- D. 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. Shop primers.
 - 6. Nonshrink grout.
- E. Survey of existing conditions.
- F. Source quality-control reports.
- G. Field quality-control 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, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 341 and AISC 341s1.
 - 3. AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use Load and Resistance Factor Design; data are given at factored-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Combined system of braced frame and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
 - 1. W-Shapes: 60 percent.
 - 2. Channels, Angles-Shapes: 60 percent.
 - 3. Plate and Bar: 25 percent.
 - 4. Cold-Formed Hollow Structural Sections: 25 percent.
 - 5. Steel Pipe: 25 percent.
 - 6. All Other Steel Materials: 25 percent.
- C. W-Shapes: ASTM A 992/A 992M.
- D. Channels, Angles: ASTM A 36/A 36M.
- E. Plate and Bar: ASTM A 36/A 36M and ASTM A 529/A 529M, Grade 50 (345).
- F. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, [Grade B] [Grade C], structural tubing.
- G. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 - 1. Weight Class: Standard unless indicated otherwise.
 - 2. Finish: Galvanized.
- H. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- I. Steel Forgings: ASTM A 668/A 668M.
- J. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, [heavy-hex] [round] head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: [Plain] [Mechanically deposited zinc coating].

- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Unheaded Anchor Rods: ASTM F 1554, or Grade 36 ASTM F 1554, Grade 55, weldable.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 5. Finish: Plain.
- F. Headed Anchor Rods: ASTM F 1554, Grade 36 ASTM F 1554, Grade 55, weldable, straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 4. Finish: Plain.
- G. Threaded Rods: ASTM A 36/A 36M and ASTM A 572/A 572M, Grade 50 (345).
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
 - 3. Finish: Plain.
- H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.4 PRIMER

- A. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.
- C. Primer: SSPC-Paint 25 BCS, Type II, zinc oxide, alkyd, linseed oil primer.
- D. Primer: SSPC-Paint 23, latex primer.
- E. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- F. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.

5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- F. 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.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Snug tightened and Slip critical.
- 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 AISC 303 for mill material.

2.8 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.
 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."

3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
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, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

- E. 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.
 - 1. Do not remove temporary shoring supporting composite deck construction 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 according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.

- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened and Slip critical.
- 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. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- 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."

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

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. Roof deck.
- 2. Composite floor deck.

B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for normal-weight structural concrete fill over steel deck.
- 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
- 3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
- 4. Section 099113 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
- 5. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Evaluation Reports: For steel deck, from ICC-ES.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1. Canam Steel Corporation; Canam Group, Inc.
 - 2. CMC Joist & Deck.
 - 3. Nucor Corp.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G90 (Z275) zinc coating.
 - 2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G90 (Z275) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 3. Deck Profile: Type NR, narrow rib.
 - 4. Profile Depth: 1-1/2 inches (38 mm).
 - 5. Design Uncoated-Steel Thickness: 0.0474 inch (1.20 mm).
 - 6. Span Condition: Triple span or more.
 - 7. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
1. Canam Steel Corporation; Canam Group, Inc.
 2. CMC Joist & Deck.
 3. Nucor Corp.
- B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
 2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray baked-on, rust-inhibitive primer.
 3. Profile Depth: 2 inches (51 mm) [As indicated].
 4. Design Uncoated-Steel Thickness: 0.0474 inch (1.20 mm).
 5. Span Condition: Triple span or more.

2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and [level] [sloped] recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- K. Galvanizing Repair Paint: ASTM A 780/A 780M.

- L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions 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, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 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 (16 mm), 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 welds a minimum of 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28 and as indicated.
- 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 18 inches (457 mm), and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.

3. 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.

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 (16 mm), 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.
 3. Weld Spacing: Space and locate welds as indicated.
 4. Weld Washers: Install weld washers at each weld location.
- 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. 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 2", with end joints as follows:
 1. End Joints: Lapped or butted at Contractor's option.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Soffit framing.

1.2 ACTION SUBMITTALS

- A. Shop Drawings:
 - 1. Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 3. Show all adjoining work and how the loads and fastening requirements of the adjoining work are accommodated by the cold formed metal framing.
 - 4. Provisions for adjustment of anchors relative to tolerances of building structure.
 - 5. Provisions for accommodating design building and thermal movements.
- B. Coordination Drawings: Provide drawings which indicate that all trades which require cold formed metal framing backup or penetrations through framing assemblies have coordinated with other contractors.
- C. Delegated-Design Submittal: Cold-formed metal framing indicated is to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation registered and licensed in the State where the project is being built.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code-Steel," and AWS D1.3, "Structural Welding Code-Sheet Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

1.6 WARRANTY

- A. Provide warranty agreeing to repair or replace defective materials and workmanship during warranty period. Defective materials and workmanship include but are not limited to: abnormal deterioration, aging or weathering; structural failure.
- B. Warranty does not include damage caused by vandalism, or natural conditions exceeding the performance requirements. Warranty and its enforcement shall not deprive Owner of other action, right or remedy.
- C. Warranty period shall be five (5) years from date of substantial completion. Warranty includes materials and labor

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
 - 1. ClarkDietrich Building Systems.
 - 2. MarinoWare; a division of Ware Industries.
 - 3. SCAFCO Corporation.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements" and as follows to design cold-formed steel framing.
 - 1. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
 - 2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on the Structural Drawings.
 - 2. Wind Loads: As indicated on the Structural Drawings.
 - 3. Deflection Limits: Design framing systems to withstand service design loads without deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing: As recommended by the manufacturer of the product being supported but not greater than 1/240.
 - 4. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/8 inch.
 - 6. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

7. Design must consider components not included in this section, including, but not limited to, miscellaneous items specified in Division 6 Section "Sheathing", Division 7 Sections "Fluid-Applied Membrane Air Barriers", "Composite Wall Panels", "Cladding Support Systems", "Expansion Control", Division 8 Sections "Aluminum-Framed Entrances and Storefronts" and "Structural-Sealant-Glazed Curtain Wall".
- C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- D. AISI Specifications and Standards: Comply with AISI S100 "North American Specification for the Design of Cold-Formed Steel Structural Members" and AISI S200 "Standard for Cold-Formed Steel Framing - General Provisions."
 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- E. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- F. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.3 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: As required by structural performance.
 2. Coating: G90 or equivalent.
 3. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: As required by structural performance.
 2. Coating: G90.
 3. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
- C. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
 2. Flange Width: As indicated on Drawings, or as required to meet performance requirements.
- D. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 1. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
 2. Flange Width: Insert dimension if manufacturer's standard width is insufficient.

- E. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
 - 2. Flange Width: As indicated on Drawings, or as required to meet performance requirements.
- F. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
 - 2. Top Flange Width: As indicated on Drawings, or as required to meet performance requirements.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
 - 2. Flange Width: As indicated on Drawings, or as required to meet performance requirements.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
 - 2. Flange Width: As indicated on Drawings, or as required to meet performance requirements.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
- 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 and lateral loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
 - 2. Flange Width: 1 inch plus twice the design gap for other applications.
- 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 and lateral loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.

- b. Flange Width: 1 inch plus twice the design gap for other applications.
- 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: As required by structural performance but not less than 0.0598 inch.
 - b. Flange Width: Insert dimension 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.

2.5 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: As required by structural performance but not less than 0.0598 inch.
 - 2. Flange Width: 2 inches, minimum.
 - 3. Hanger Wire: 0.162 inches, minimum.
 - 4. Coating: G90.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight 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. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers, knee braces, and girts.
 - 9. Hole reinforcing plates.
 - 10. Backer plates.
 - 11. Bent plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Not allowed.
- E. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

- A. Fabricate cold-formed metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

- B. Fasten both flanges of studs to deflection track and/or top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As required by design or by material requiring backup, whichever is smaller..
- 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-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 metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 SOFFIT INSTALLATION

- A. Install perimeter soffit track sized to match other members. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Frame openings with built-up headers consisting of framing members and track, nesting members, or another combination of connected members if indicated.
- C. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each intersection as follows:
 - 1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- D. Install miscellaneous framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable soffit-framing assembly.

3.6 FIELD QUALITY CONTROL

- A. Testing: **Owner-Contractor** will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.

- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

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SECTION 054523 - LABORATORY METAL SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Strut-type steel framing and supports for laboratory equipment.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 2. Steel weld plates and angles for casting into concrete not specified in other Sections.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Scheduling and Coordination: Coordinate metal support system with applicable equipment manufacturer and installer. Coordinate with related construction where medical equipment is to be installed, including ceiling system installer where applicable; to ensure metal supports are installed prior to related construction installation.

1.3 ACTION SUBMITTALS

- A. Product Data: Including materials, strengths, finishes and standard component sizes.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.
 - 2. Product Data for Credit MR5.1 and Credit MR5.2: Submit a statement from metal manufacturer stating the distance between the place of extraction, processing, and manufacture and the project location.
- C. Shop Drawings: Show fabrication and installation details for metal supports, including plans, elevations, sections, and details of metal supports and their connections. Show anchorage and accessory items.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
 - 2. 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.
- D. Delegated-Design Submittal: For products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates
 - 1. Welding Certificates.
 - 2. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
 - 3. Quality Assurance Program Certification: From manufacturer certifying that all components provided for this Project have been manufactured in accordance with manufacturer's established quality assurance program.
- B. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: 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."
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Manufacturer's Qualifications: Not less than 10 years' experience in manufacture and installation of adjustable metal framing support systems and capable of demonstrating experience with completed projects of similar scope and size.
 - 1. Quality Assurance Program: Maintain a continuing Quality Assurance Program for material, fabrication and installation.
- D. Single Source: Provide metal support systems manufactured, supplied, engineered and installed by a single company.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal supports by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 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. 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.

1.8 WARRANTY

- A. Manufacturer's Warranty: Provide warranty from metal support system manufacturer covering materials and workmanship of metal support system for not less than 2 years after the Date of Substantial Completion.
 - 1. In addition to written warranty, plainly mark support system with manufacturer's standard warranty and identification tag system, permanently attached to component and marked with the manufacturer's name, project number, telephone number and date of installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal supports exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless otherwise indicated.

- F. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches .
 - 2. Steel: ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- G. Fasteners
 - 1. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
 - 2. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - a. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
 - 3. Eyebolts: ASTM A 489.
 - 4. Machine Screws: ASME B18.6.3.
 - 5. Lag Bolts: ASME B18.2.1.
 - 6. Wood Screws: Flat head, ASME B18.6.1.
 - 7. Plain Washers: Round, ASME B18.22.1.
 - 8. Lock Washers: Helical, spring type, ASME B18.21.1.
 - 9. Anchors: Anchors capable of sustaining, 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.
 - a. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
 - b. Post-Installed Anchors: Torque-controlled expansion anchors, carbon-steel zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
- H. Miscellaneous Materials
 - 1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 2. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer.
 - 3. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 STRUT-TYPE STEEL FRAMING AND SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - 1. Unistrut Building Systems.
 - 2. Hilti Inc.
 - 3. Flex-Strut Inc.
 - 4. Cooper B-Line, Inc.
- B. Performance Requirements
 - 1. Delegated Design: Design metal support systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated in this Section and on the Drawings.
 - a. Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements."

2. Standards: Comply with applicable requirements of federal, state and local codes as well as requirements of authorities having jurisdiction.
 - a. Provide system designated as a Life Safety System.

C. Design Requirements

1. Support Structure: Locate support members as indicated on Drawings. Provide channels spaced to allow installation of related construction and accommodating attachment of medical equipment at any point of the support system.
 - a. Unless otherwise indicated, provide channels consisting of 2 roll formed sections welded together horizontally to form metal framing slots top and bottom with configuration substantially reducing weld tension.
 - b. Provide section profile allowing integral attachment of diagonal bracing at mid-section with continuous 16 gage ledge angles spot welded to finish rails at the level of the finish construction. Paint ledge angles to match finish rails.
 - c. Provide plastic closure strip in length equivalent to total length of finish rails for installation after equipment installation.
2. Ceiling Anchorage: Whenever possible, attach to ceiling structure with embedded concrete inserts, through bolts, or by direct attachment to the structural framing of the building.
3. Vertical Supports: Connect exposed rails and related construction anchorage with series of 12 gage vertical supports as indicated on Drawings, providing both basic and micro adjustment.
4. Seismic Bracing: Brace to meet all requirements of applicable codes.
5. Loading: Design support structure to accommodate a concentrated load, as shown on manufacturer's drawings, at any single point along the exposed rails with maximum concentrated load that will be encountered by positioning the equipment at the extremities of its travel (maximal load configuration).
6. Safety Factor: Design with minimum safety factor of 2 based upon ultimate strength under static loading conditions.
7. Deflection: Not more than $L/720$ but not less than requirements of manufacturer of supported equipment for applications shown on Drawings.

2.3 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 supports after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.4 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. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal supports:

1. Other Items (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to 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

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal support system. Set metal support system 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. Field-weld connections that are not exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of 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 support system is 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. Installation of Metal Support System
 1. Attach metal support system to structure as indicated on Drawings, complying with metal support system manufacturer's recommendations.
 2. Form pattern as indicated, or if not indicated, as required to provide adequate support for equipment while coordinating with layout of adjacent construction and equipment. Coordinate requirements with trades providing construction integrated with the support system.
 3. Installation Tolerance: Install components so that metal support system members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

3.2 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 054523

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel framing and supports for operable partitions.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Elevator machine beams, hoist beams,.
6. Steel shapes for supporting elevator door sills.
7. Shelf angles.
8. Loose bearing and leveling plates for applications where they are not specified in other Sections.
9. Metal ladders.
10. Alternating tread devices.
11. Metal bollards.
12. Elevator pit sump covers.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete not specified in other Sections.

1.2 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 metal fabrications that are anchored to or that receive other work . 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.**

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. LEED Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Show fabrication and installation details for metal fabrications.

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.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1, "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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications 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.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Post-consumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- D. Lag Bolts: ASME B18.2.1.
- E. Plain Washers: Round, ASME B18.22.1.
- F. Lock Washers: Helical, spring type, ASME B18.21.1.
- G. Anchors, General: Anchors capable of sustaining, 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.
- H. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- I. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- J. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Provide zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat, at all exterior steel framing and support elements.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing 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.

2.5 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.

2.6 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. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

2.8 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.11 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.
- B. Steel Ladders:
 - 1. Space siderails 18 inches apart, unless otherwise indicated.
 - 2. Space siderails of elevator pit ladders 12 inches apart.
 - 3. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
 - 4. Rungs: 1-inch- diameter steel bars.
 - 5. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
 - 7. Prime ladders, including brackets and fasteners, with zinc-rich primer.

2.12 ALTERNATING TREAD DEVICES

- A. Alternating Tread Devices: Fabricate alternating tread devices to comply with ICC's International Building Code. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lapeyre Stair Inc.
 - b. Schmidt Structural Products
 2. Tread depth shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, tread width shall be not less than 7 inches, and riser height shall be not more than 9-1/2 inches.
 3. Fabricate from steel and assemble by welding or with stainless-steel fasteners.
 4. Comply with applicable railing requirements in Division 05 Section "Pipe and Tube Railings."
- B. Prime steel alternating tread devices, including treads, railings, brackets, and fasteners, with zinc-rich primer.
- 2.13 METAL BOLLARDS
- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - B. Prime bollards with zinc-rich primer.
- 2.14 ELEVATOR PIT SUMP COVERS
- A. Fabricate from welded or pressure-locked steel bar grating Limit openings in gratings to no more than 1 inch in least dimension.
 - B. Provide steel angle supports as indicated.
- 2.15 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.
 - C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- 2.16 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.
 3. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
 - C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
 - D. Shop Priming: Apply shop primer to 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.

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 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 nonshrink 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.

3.4 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 1. Do not fill removable bollards with concrete.

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- B. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.

3.5 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

SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.
4. Railing gates at the level of exit discharge.

1.2 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 metal stairs. 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.
- C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.3 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Prefilled metal-pan-stair treads.
2. Precast concrete treads.
3. Nonslip aggregates and nonslip-aggregate finishes.
4. Abrasive nosings.
5. Paint products.

B. LEED Submittals:

- 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. 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..
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 - 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, 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 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.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- 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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.
- F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30, unless another grade is required by design loads.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors chemical anchors capable of sustaining, 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/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- C. Concrete Materials and Properties: Comply with requirements in Section 033000 "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.
- D. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- E. Welded Wire Reinforcement: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.5 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 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 3 welds: partially dressed weld with spatter removed.
- 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.

2.6 STEEL-FRAMED STAIRS

- A. Stair Framing:
 1. Fabricate stringers of steel plates or channels.
 - a. Provide closures for exposed ends of channel stringers.
 2. Construct platforms of steel plate or 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 shaft-wall 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.
- B. Metal Pan Stairs: Form risers, subtread 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. Steel Sheet: Uncoated cold or hot-rolled steel sheet.
 2. Directly weld metal pans to stringers; locate welds on top of subtreads where they are concealed by concrete fill. Do not weld risers to stringers.
 3. Shape metal pans to include nosing integral with riser.
 4. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
 5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.7 STAIR RAILINGS

- A. Comply with applicable requirements in
 1. Fabricate newels of square steel tubing and provide newel caps of pressed steel, as shown.
 2. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
 3. Connect posts to stair framing by direct welding unless otherwise indicated.
- B. 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. Rails and Posts: 1-5/8-inch- diameter top and bottom rails and 1-1/2-inch- square posts.
 2. Picket Infill: 1/2-inch- round pickets spaced less than 4 inches clear.
 3. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with spring hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

- C. 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.
- D. Form changes in direction of railings as follows:
 - 1. As detailed.
- E. 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.
- F. Close exposed ends of railing members with prefabricated end fittings.
- G. 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 or less.
- H. Connect posts to stair framing by direct welding unless otherwise indicated.
- I. 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 nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 - 2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
- J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be 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 metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. 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.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

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 welding or 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 required to comply with performance requirements.

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 dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. 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

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe and tube railings.

1.2 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.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality 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:
 - 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.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F.

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 with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.

2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
 3. Provide exposed fasteners with finish matching 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 indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
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.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For 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.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- H. Intermediate Coats and Topcoats: Provide products that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- I. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- J. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 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. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. 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.
- 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. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded nonwelded connections unless otherwise indicated.
- 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 surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- 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.
 - 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. As detailed.
- L. 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.
- M. Close exposed ends of railing members with prefabricated end fittings.
- N. 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 or less.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

- P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 - 3. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

- 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. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. 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.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. 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.
- C. 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, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. 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

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. 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.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and .
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and .
- C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 057100 - DECORATIVE METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes steel-framed decorative metal stairs.

1.2 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 metal stairs. 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Paint products.
 - 2. Grout.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 METAL STAIRS, GENERAL

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Architectural class, unless more stringent requirements are indicated.

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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25, unless another grade is required by design loads; exposed.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

2.5 PRECAST EPOXY-RESIN TERRAZZO

- A. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1. Wausau Tile Inc.
- B. Precast Terrazzo Units: Comply with NTMA's written recommendations for fabricating precast terrazzo 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 (3.2-mm) radius.
 - 1. Stair tread and riser units.
 - 2. Color, Pattern, and Finish: Custom mix as selected by Architect.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, 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. 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 with accurate angles and surfaces and straight edges.
- E. 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 1 welds: no evidence of a welded joint.
- 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.

2.7 STEEL-FRAMED STAIRS

- A. Stair Framing:
1. Fabricate stringers of steel plates or channels .
 - a. Provide closures for exposed ends of channel stringers.
 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as indicated.
 3. Weld stringers to headers; weld framing members to stringers and headers.
- B. Subtreads, Risers, and Subplatforms:
1. Fabricate subtreads and subplatforms of steel plates.
 2. Weld subtreads to stringers. Locate welds on top of subtreads where they will be concealed by finished treads.
 3. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 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. 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.

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- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- E. 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.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 057100

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel decorative railings.

1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.3 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with ~~topcoats~~ **finish coating** to be applied over them. Comply with ~~paint and~~ coating manufacturers' written instructions to ensure that shop primers and ~~topcoats~~ **finish coatings** are compatible.
- 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 items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Manufacturer's product lines of railings assembled from standard components.
- B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Shop Drawings: Include plans, elevations, sections, and attachment details.
- D. 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.
 2. Fittings and brackets.
 3. Welded connections.
 4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

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."

B. Finish: Comply with AAMA 2604.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. See Section 016000 "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
- C. 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:
 - 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.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 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: Same metal and finish as supported rails unless otherwise indicated.
 - 1. Provide formed-steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

2.4 STEEL ~~AND IRON~~

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Tubing: ASTM A 513.
- C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Uncoated Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed; Type 304 stainless-steel fasteners where exposed.
 - 2. Galvanized-Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - 3. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.
- 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 or ICC-ES AC308.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. 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.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. 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 nonwelded connections unless otherwise indicated.
- 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 Type 1 welds; no evidence of a welded joint.
- I. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. As detailed.
- K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated end fittings.
- M. 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 or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 — ~~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: Custom color selected by the Architect.**~~

2.10 STEEL ~~AND IRON~~ FINISHES

- A. Powder-Coat Finish: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
 - 1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 - 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 - 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils.
 - 4. Color: Custom color selected by Architect.
- B. Basis-of-Design: Tiger Drylac Powder Coatings.**

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. 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.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

- 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.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

- A. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- B. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.4 ATTACHING RAILINGS

- A. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.
- B. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.5 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of ~~shop paint~~ **powder coating**, and paint exposed areas with the same material 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.

3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. 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 057300

SECTION 057313 - GLAZED DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass- and plastic-supported railings.

1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.3 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.
- 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 items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of railings assembled from standard components.
 - 2. Grout, anchoring cement, and paint products.
- B. LEED Submittals:
 - 1. Certificates for Credit MR 6: Chain-of-custody certificates indicating that wood rails comply with forest certification and chain-of-custody requirements. Include statement indicating cost for each certified wood product.
- C. Shop Drawings: Include plans, elevations, sections, and attachment details.
- D. 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.
 - 2. Each type of glass required.
 - 3. Fittings and brackets.
 - 4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

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1.6 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.7 QUALITY ASSURANCE

- A. 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 mockups as shown on Drawings.
 - 2. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide The Wagner Company or comparable product by one of the following:
 - 1. C. R. Laurence Co., Inc.
 - 2. Livers Bronze Co.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. See Section 016000 "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.

2. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
- C. 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:
 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.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
 3. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

2.3 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: Same metal and finish as supported rails unless otherwise indicated.

2.4 GLASS AND GLAZING MATERIALS

- A. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.
- B. Laminated Glass: ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with two plies of glass and polyvinyl butyral interlayer not less than 0.060 inch thick.
 1. Kind: LT (laminated tempered) .
 2. Glass Color: Clear.
 3. Interlayer Color: Clear.
 4. Glass Plies for Structural Glass Balusters: Thickness required by structural loads, but not less than 6.0 mm thick each.
- C. Safety Glazing Labeling: Permanently mark 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.
- D. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.
 1. Glazing Cement: Nonshrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.

2.5 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 1. Dissimilar Metals: Type 304 stainless-steel fasteners.

- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.
 - 1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.
- 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 or ICC-ES AC308.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Wood Rails: Clear, straight-grained hardwood rails secured to recessed metal subrail.
 - 1. Species: White oak.
 - 2. Finish: Transparent polyurethane .
 - 3. Staining: As selected by Architect from manufacturer's full range.
 - 4. Profile: Round, 2-inch diameter unless indicated otherwise.
 - 5. Certified Wood: Fabricate wood rails from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. Brackets: Basis-of-Design The Wagner Company
 - 1. Wall: MB3250W
 - 2. Glass: GB3270
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

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. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. 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.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

- G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- H. Form changes in direction as follows:
 - 1. As detailed.
- I. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- J. Close exposed ends of hollow railing members with prefabricated end fittings.
- K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- L. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.8 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
 - 1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
 - 2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.
- B. Structural Balusters: Provide laminated, tempered glass panels for both straight and curved sections.

2.9 GENERAL FINISH REQUIREMENTS

- A. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. 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.

- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

- 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.

3.3 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, .

3.4 INSTALLING GLASS PANELS

- A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
 - 1. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass panels.
 - 2. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement.
 - a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
 - 3. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
 - 4. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made by Owner.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
- D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

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3.6 CLEANING

- A. Clean and polish as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. 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 057313

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SECTION 057500 - DECORATIVE FORMED METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Beam wraps.
2. Closures and trim.
3. Metal base.

1.2 COORDINATION

- A. Coordinate installation of anchorages for decorative formed metal items. 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 items to Project site in time for installation.
- B. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for decorative formed metal.
1. Include plans, elevations, component details, and attachment details.
 2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For each type of exposed finish required, prepared on 6-inch- square Samples of metal of same thickness and material indicated for the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
- B. Qualification Data: For Installer, fabricator, and powder-coating applicator.
- C. Mill Certificates: Signed by stainless-steel manufacturers certifying that products furnished comply with requirements.
- D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce required units.

- B. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- C. Installer Qualifications: Fabricator of products.
- D. 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 mockups for the following types of decorative formed metal:
 - a. Full stair 1 vertical wall enclosure at one floor level.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
- B. Store products on elevated platforms in a dry location.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SHEET METAL

- A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Aluminum Sheet: Flat sheet complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.

2.2 MISCELLANEOUS MATERIALS

- A. Sealants, Interior: Nonsag, paintable sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.
- B. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
 - 1. Use filler metals that will match the color of metal being joined and will not cause discoloration.
- C. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 - 1. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless otherwise indicated.

- D. Nonstructural Anchors: For applications not indicated to comply with design loads, provide fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
- E. Anchor Materials:
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
- F. Sound-Deadening Materials:
 - 1. Mastic: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Backing Materials: Provided or recommended by decorative formed metal manufacturer.
- H. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal, will prevent telegraphing and oil-canning, and is compatible with substrate and noncombustible after curing.

2.3 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.
- F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.
- G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.
 - 1. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.
- H. Back cut inside face at all outside corner bends to produce crisp edge.

2.4 BEAM WRAPS

- A. Form beam wraps from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
 - 1. Aluminum Sheet: 0.063 inch.
 - a. Finish: Baked enamel or powder coat.

- B. Fabricate with calk stop angle to retain backer rod and sealant.

2.5 CLOSURES AND TRIM

- A. Form closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
 - 1. Aluminum Sheet: 0.063 inch in all locations except use 0.125 inch thick at vertical wall wrap.
 - a. Finish: Baked enamel or powder coat.
 - 2. Closures and trim may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view and not exposed to weather.
- B. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.
- C. Drill and tap holes needed for securing closures and trim to other surfaces.
- D. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.
- E. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

2.6 METAL BASE

- A. Form metal base from metal of type and thickness indicated below:
 - 1. Aluminum Sheet: 0.063 inch.
 - a. Finish: Baked enamel or powder coat.

2.7 GENERAL FINISH REQUIREMENTS

- A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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 the 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.

2.8 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.

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 decorative formed metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.
- E. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.
- F. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

- A. Unless otherwise indicated, clean metals by washing thoroughly with water and soap, rinsing with clean water, and drying with soft cloths.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed 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.
- C. 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.

3.4 PROTECTION

- A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 057500

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SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2.2 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; GlasRoc.
 - b. G-P Gypsum Corporation; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond e(2)XP.
 - d. United States Gypsum Co.; Securock.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches for vertical installation.

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Unless otherwise indicated, install sheathing products in accordance with sheathing product manufacturer's recommendations for applications indicated on Drawings.
- B. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- C. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- D. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- E. Use common wire 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 connections. Install fasteners without splitting wood.
- F. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- G. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- H. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 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 boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch 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. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

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1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Treatment of sheathing joints to be coordinated with requirements of Division 07 Section Fluid-Applied Membrane Air Barriers to ensure compatibility.
 2. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 3. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

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SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood furring.
4. Wood sleepers.
5. Plywood backing panels.

1.2 DEFINITIONS

- A. Boards or Strips:** Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber:** Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. LEED Submittals:

1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
2. Certificates for Credit MR 7: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.

2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

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.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Regional Materials: Dimension lumber, except treated materials, shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Certified Wood: Lumber and plywood shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- C. 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. Dress lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with 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, chemical formulations shall 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 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, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates that are installed over concrete slabs-on-grade.

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 E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 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 D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a 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 all miscellaneous carpentry unless otherwise indicated.

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. Furring.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

- C. 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.
- D. 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.
- E. 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: Plywood, DOC PS 1, Exterior, A-C , fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
 - 1. Plywood 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."

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where 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. Screws for Fastening to Metal Framing: ASTM C 1002 or ASTM C 954, length as recommended by screw manufacturer for material being fastened.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on 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. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 .

2.7 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
 - 2. Adhesives 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."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. 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.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. 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 o.c.
- G. 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 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 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 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. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- H. 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.
- I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 3. ICC-ES evaluation report for fastener.
- L. 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 connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for [**screeding or**] attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.4 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-veneer architectural wood cabinets (included in term "millwork").
2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
3. Shop finishing of architectural wood cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including cabinet hardware and accessories and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. LEED / Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
5. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: For architectural cabinets.

1. Include plans, elevations, sections and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood cabinets.
5. Show locations of lighting luminaires, their control locations and electrical wiring connections point(s).
6. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
7. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Verification:

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-faced panel products with or for transparent finish, 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.
3. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
4. Corner pieces as follows:

- a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
5. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of product, signed by product manufacturer.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 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. Shop is a certified participant in AWI's Quality Certification Program.

1.5 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.

1.6 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. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- C. 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.
- D. 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.

1.7 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-veneer-faced architectural cabinets can be supported and installed as indicated.

- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 "Door Hardware" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOOD CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide inspections of fabrication together with labels from AWI certification program indicating that woodwork complies with requirements of grades specified.
 - 2. 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 CABINETS FOR TRANSPARENT FINISH

- A. Grade: Custom.
- B. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- D. Type of Construction: Frameless.
- E. Cabinet and Door and Drawer Front Interface Style: Flush overlay.
- F. Wood for Exposed Surfaces:
 - 1. Species: White oak.
 - 2. Blueprint Matching: Comply with veneer and other matching requirements indicated for blueprint-matched paneling.
 - 3. Cut: Rift cut/rift sawn.
 - 4. Grain Direction: Horizontal.
 - 5. Matching of Veneer Leaves: Book match.
 - 6. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain. Match adjacent wood paneling.
- G. Semiexposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
 - 2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
 - 3. Drawer Bottoms: Hardwood plywood.
- H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. 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 WOOD 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. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 2. 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. MDF: ANSI A208.2, Grade 130.
 2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing; equivalent to following:
 1. Blumm No. 71 6580 with Plate 173H9100
 2. Grass No. 3903VZ with mounting plate 10761
 3. Hafele No. 329.07.654 with plate
- C. Touch Latch: BHMA A156.9, heavy duty latch.
- D. Shelf Rests: BHMA A156.9, B04013; metal.
- E. Drawer Slides: BHMA A156.9, B05111; Side-mounted, full-extension, all ball bearing zinc-plated steel drawer slides with hold-in detent, rated for indicated loads, and equivalent to the following:
 1. Drawers 6-inches or less in depth and up to 16-inches in width:
 - a. Model 3832SC, 100 lb./pr. load rating, telescoping, self-closing movement, by Accuride International, or approved equal.
 2. Drawers 6-inches or less in depth and up to 24-inches in width:
 - a. Model 7432, 100 lb./pr. load rating, progressive movement, by Accuride International, or approved equal.
 3. Drawers over 6-inches in depth and up to 42-inches in width:
 - a. Model 3640, 200lb./pr. load rating, sequential movement, by Accuride International, or approved equal.
- F. Door and Drawer Locks:
 1. Door and Drawer Locks: Multi-function pin tumbler cam locks suitable for specific project applications. All brass construction with 26D-Dull Chrome finish, equivalent to "No. C8103 by National Lock Co.," or approved equal. Provide two stamped brass keys per lock. Locks to be capable of 850 key changes.

2. All locks shall be keyed alike within each room and masterkeyed, including locks on under-counter refrigerators. Locks on inner and outer doors of narcotics cabinets shall be keyed separately.

G. Door and Drawer Silencers: BHMA A156.16, L03011.

H. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "OG Series" by Doug Mockett & Company, Inc.

I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 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.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.6 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets: 1/16 inch unless otherwise indicated.

C. Complete fabrication, including assembly, finishing, 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. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. 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.

D. 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.

2.7 SHOP FINISHING

- A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: System - 11, catalyzed polyurethane.
 - 3. Staining: None required.
 - 4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 5. Sheen: Flat, 15-30 gloss units measured on 60-degree gloss meter per ASTM D 523.

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, including removal of packing and backpriming.

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.
- 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. For shop finished items use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

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- G. Touch up finishing work specified in this Section after installation of woodwork. 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 cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064113

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SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets (included in term "millwork").
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
3. Plastic laminate shelves and coat rods.

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 high-pressure decorative laminate adhesive for bonding plastic laminate fire-retardant-treated materials and cabinet hardware and accessories.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
5. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

- C. Shop Drawings:** Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
4. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish and specified edge material applied to one edge.
2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish and specified edge material applied to one edge.
3. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
4. Corner pieces as follows:

- a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 - 5. Exposed cabinet hardware and accessories, one unit for each type and finish.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For fabricator.
 - B. Product Certificates: For each type of product, signed by product manufacturer.
 - C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- 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. Shop is a certified participant in AWI's Quality Certification Program.
- 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 between 60 and 90 deg F and relative humidity between 25 and 55 percent 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.
 - B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087111 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 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. Provide labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
 - 2. 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: Custom.
- C. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- D. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- E. Type of Construction: Frameless.
- F. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- G. Reveal Dimension: As indicated.
- H. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
- I. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS.
 - 3. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - 4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- J. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermoset decorative panels.
- K. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- L. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- M. 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.
- N. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated by laminate manufacturer's designations.

2.2 WOOD 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. Composite Wood Products: Products shall be made without urea formaldehyde.
 2. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 4. Softwood Plywood: DOC PS 1.
 5. Thermoset Decorative Panels: 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.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing; equivalent to following:
1. Blumm No. 71 6580 with Plate 173H9100
 2. Grass No. 3903VZ with mounting plate 10761
 3. Hafele No. 329.07.654 with plate
- C. Wire Pulls: Back mounted, BHMA A156.9, Satin Clear Anodized, 4 inches long, 5/16 inch in diameter; equivalent to the following:
1. No. 4484 by Stanley Hardware.
 2. No. MC-4024 by Epco Hardware.
 3. No. 6208 by National Lock and Cabinet Hardware.
- D. Catches: Magnetic catches, BHMA A156.9, B03141, Grade 1, with clear anodized aluminum case and impregnated floating rubber magnet, zinc plated strike, slotted screw holes in case and off-center hole in strike, equivalent to No. SP41 or SP45 by Stanley Hardware, or approved equal..
- E. Shelf Rests: BHMA A156.9, B04013; metal.
- F. Counter Support Brackets:
1. Basis-of-Design Product: Subject to compliance with requirements, provide "Rakks Counter Support Bracket, EH Series" by the Rangine Corporation or acceptable comparable product.
 2. Configuration: Flush mounted.

3. Material: ASTM B221, 6063 T5, horizontal T-shape and vertical L-shape extruded aluminum bracket with MIG welding across 45-degree miters and back.
 4. Load Capacity: 450 pounds per bracket minimum.
 5. Faceplates: 4-inch by 4-inch aluminum faceplates with adhesive backing, notched to fit around vertical flange of flush mounted counter support bracket, to conceal penetration through gypsum board.
 6. Finish: Custom powder coat finish as selected by Architect from manufacturer's full range.
- G. Drawer Slides: BHMA A156.9, B05111; Side-mounted, full-extension, all ball bearing zinc-plated steel drawer slides with hold-in detent, rated for indicated loads, and equivalent to the following:
1. Drawers 6-inches or less in depth and up to 16-inches in width:
 - a. Model 3832SC, 100 lb./pr. load rating, telescoping, self-closing movement, by Accuride International, or approved equal.
 2. Drawers 6-inches or less in depth and up to 24-inches in width:
 - a. Model 7432, 100 lb./pr. load rating, progressive movement, by Accuride International, or approved equal.
 3. Drawers over 6-inches in depth and up to 42-inches in width:
 - a. Model 3640, 200lb./pr. load rating, sequential movement, by Accuride International, or approved equal.
- H. Door and Drawer Locks:
1. Door and Drawer Locks: Multi-function pin tumbler cam locks suitable for specific project applications. All brass construction with 26D-Dull Chrome finish, equivalent to "No. C8103 by National Lock Co.," or approved equal. Provide two stamped brass keys per lock. Locks to be capable of 850 key changes.
 2. All locks shall be keyed alike within each room and masterkeyed, including locks on under-counter refrigerators. Locks on inner and outer doors of narcotics cabinets shall be keyed separately.
- I. Grommets for Cable Passage through Countertops: 2-inch OD, to match laminate, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Product: Subject to compliance with requirements, provide "SG Series" by Doug Mockett & Company, Inc.
- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- L. Closet Rod and Shelf Brackets: Basis-of-Design Product, Knappe & Vogt as indicated below:
1. Bracket: Extra Duty Series 1199, Warm White.
 2. Rod: Extra Duty Series 770.
- 2.4 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.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate cabinets to dimensions, profiles, and details indicated.
- C. 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. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. 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.
- D. 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.
- E. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

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.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

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- 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.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

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SECTION 064216 - FLUSH WOOD PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flush wood paneling (wood-veneer wall and ceiling surfacing).
2. Wood furring, blocking, shims, and hanging strips for installing flush wood paneling unless concealed within other construction before paneling installation.
3. Shop finishing of flush wood paneling.

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 finishing materials and processes.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
3. Certificates for Credit MR 7: Chain-of-custody certificates indicating that paneling complies with forest certification and chain-of-custody requirements. Include statement indicating cost for each certified wood product.
4. Product Data for Credit IEQ 4.1: For installation adhesives, documentation including printed statement of VOC content.

- ##### C. Shop Drawings:
- Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.

1. Show details full size.
2. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
3. For paneling produced from premanufactured sets, show finished panel sizes, set numbers, sequence numbers within sets, and method of cutting panels to produce indicated sizes.
4. For paneling veneered in fabrication shop, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply WI Certified Compliance Program label to first page of Shop Drawings.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Shop-applied opaque finishes.

E. Samples for Verification:

1. Lumber for transparent finish, not less than 5 inches wide by 24 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 paneling.
3. Veneer-faced panel products for transparent finish, 12 by 12 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.

1.4 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. Shop is a certified participant in AWI's Quality Certification Program.
- B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver paneling until painting and similar operations that could damage paneling have been completed in installation areas. If paneling must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where paneling 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 paneling by field measurements before being enclosed and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

PART 2 - PRODUCTS

2.1 PANELING, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of flush wood paneling (wood-veneer wall surfacing) 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. Regional Materials: Paneling shall be manufactured within 500 miles of Project site.
 1. Composite wood materials used for paneling shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered within 500 miles of Project site.
 2. Veneers used for paneling shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered within 500 miles of Project site.
 3. Lumber used for paneling shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered within 500 miles of Project site.

2.2 FLUSH WOOD PANELING (WOOD-VENEER WALL SURFACING)

- A. Grade: Premium.
- B. Certified Wood: Wood and composite wood components of flush wood paneling shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- C. Wood Species and Cut: White oak, rift sliced, grain to run horizontally unless noted otherwise.
- D. Matching of Adjacent Veneer Leaves: Book match.
- E. Matching within Panel Face: Running match.
- F. Matching of Adjacent Veneer Leaves and within Panel Face: Slip, center, book match.
- G. Panel-Matching Method: Made-to-order, sequence-matched panels within each separate area.
- H. Vertical Panel-Matching Method: Continuous end match; veneer leaves of upper panels are continuations of veneer leaves of lower panels.
- I. Panel Core Construction: Hardwood veneer-core plywood.
 1. Thickness: 3/4 inch unless indicated otherwise.
- J. Exposed Panel Edges: Inset solid-wood or wood-veneer matching faces.
- K. Metal Inlay: Flush with panels, naval brass with lacquer coating, 1/16 inch thick, satin finish.
- L. Assemble panels by gluing and concealed fastening.
- M. Fire-Retardant-Treated Paneling: Panels shall consist of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard. Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E 84 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction. Use where panel exceeds 10 percent of that walls surface.

2.3 FLUSH WOOD PANELING (OPAQUE FINISH)

- A. Grade: Custom.
- B. Certified Wood: Wood and composite wood components of flush wood paneling shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

- C. Panel Core Construction: Hardwood veneer-core plywood.
 - 1. Thickness: 3/4 inch unless indicated otherwise.
- D. Faces: ~~Any closed-grain hardwood.~~ **Medium-density overlay.**
 - 1. **Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers or directly to high-density hardboard crossbands. (Add 3-1)**
- E. Exposed Panel Edges: Inset solid-wood or wood-veneer matching faces.
- F. Metal Inlay: Flush with panels, naval brass with lacquer coating, 1/16 inch thick, satin finish.
- G. Assemble panels by gluing and concealed fastening.
- H. Fire-Retardant-Treated Paneling: Panels shall consist of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard. Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E 84 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction. Use where panel exceeds 10 percent of that walls surface.

2.4 MATERIALS

- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Moisture Content: 5 to 10 percent.
- C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
 - 1. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

2.5 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying 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.
 - 1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use 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 E 84, 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.

2.6 INSTALLATION 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.
- C. Two piece interlocking zee-clips mechanically attached to back of panel and wall.
 - 1. Extruded 6063-T6 aluminum in accordance to ASTM B 221; mill finish.
 - 2. Lift-off: 3/8 inch.
 - 3. Projection: 1/4 inch.
 - 4. Total Height: 2-3/8 inches with two clip sections fully engaged.
- D. VOC Limits for Installation Adhesives: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Multipurpose Construction Adhesives: 70 g/L.
 - 3. Contact Adhesive: 80 g/L.
 - 4. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
- E. Hinges: Where indicated, provide "hidden door" panel with Soss 208 invisible hinges and door thickness as indicated on the drawings.
- F. Latch: Provide latch that locks as approved by the Architect.

2.7 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Arrange paneling in shop or other suitable space in proposed sequence for examination by Architect. Mark units with temporary sequence numbers to indicate position in proposed layout.
 - 1. Lay out one elevation at a time if approved by Architect.
 - 2. Notify Architect seven days in advance of the date and time when layout will be available for viewing.
 - 3. Provide lighting of similar type and level as that of final installation for viewing layout unless otherwise approved by Architect.
 - 4. Rearrange paneling as directed by Architect until layout is approved.
 - 5. Do not trim end units and other non-modular-size units to less than modular size until after Architect's approval of layout. Indicate trimming by masking edges of units with non-marking material.
 - 6. Obtain Architect's approval of layout before start of assembly. Mark units and Shop Drawings with assembly sequence numbers based on approved layout.
- C. Complete fabrication, including assembly and finishing, 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. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.

- D. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.8 SHOP FINISHING

- A. General: Finish paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing paneling, as applicable to each unit of work.
 - 1. Backpriming: Apply two coats of sealer or primer, compatible with finish coats, to concealed surfaces of paneling. Concealed surfaces of plastic-laminate-clad paneling do not require backpriming when surfaced with plastic laminate.
- C. Transparent Finish:
 - 1. Grade: Custom.
 - 2. Finish: System - 11, catalyzed polyurethane.
 - 3. Staining: Match approved sample for color.
 - 4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 5. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
 - 6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.
- D. Opaque Finish:
 - 1. Grade: Custom.
 - 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 2, precatalyzed lacquer.
 - 3. Color: Three (3) different colors of white as selected by Architect.
 - 4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition paneling to average prevailing humidity conditions in installation areas.
- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install paneling to comply with same grade as paneling to be installed.
- B. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
 - 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/16 inch.
- C. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless covered by trim or otherwise indicated.

- D. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. 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.
- E. Refer to Section 099300 "Staining and Transparent Finishing" for final finishing of installed paneling.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling, where possible, to eliminate defects; where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064216

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SECTION 064600 - WOOD TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
3. Shop finishing of wood trim.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials and processes.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
4. Product Data: For installation adhesives, indicating VOC content.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.

E. Samples for Verification:

1. Lumber for transparent finish, not less than 5 inches wide by 24 inches long, for each species and cut, finished on one side and one edge.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 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. Shop is a certified participant in AWI's Quality Certification Program.

1.5 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.

1.6 FIELD CONDITIONS

- A. Weather Limitations for Exterior Work: Proceed with installation of exterior wood trim only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.
- B. 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 between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 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. Provide certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
 - 2. 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 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Custom .
- B. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- D. Wood Species and Cut:
 - 1. Species: White oak .
 - 2. Cut: Quarter cut/quarter sawn.
- E. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
 - 1. For veneered base, use hardwood lumber core, glued for width.
- F. For base wider than available lumber, glue for width. Do not use veneered construction.
- G. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 2. Wood Moisture Content for Interior Materials: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Exterior Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
1. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC3b.
 - a. Kiln dry lumber after treatment to a maximum moisture content of 19 percent.
 - b. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.
- B. Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- C. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- D. 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.
- E. Adhesives: Do not use adhesives that contain urea formaldehyde.
- F. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.
1. Adhesives shall have a VOC content of 70 g/L or less.

2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.
- D. Assemble casings in shop except where shipping limitations require field assembly.
- E. Assemble moldings in shop to maximum extent possible. Miter corners in shop and prepare for field assembly with bolted fittings designed to pull connections together.

2.6 SHOP FINISHING

- A. General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to end-grain surfaces.
- C. Transparent Finish for Interior Trim:
 - 1. Grade: Custom .
 - 2. Finish: System - 11, catalyzed polyurethane.
 - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 4. Staining: Match approved sample for color.
 - 5. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
 - 6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.
- B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install wood trim to comply with same grade as item to be installed.
- B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install wood trim 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.
- D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor wood trim 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. 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 60 inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - 1. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
 - 2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
 - 3. Install wall railings on indicated metal brackets securely fastened to wall framing.
- 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.

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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

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SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
2. Product Data for Credit IEQ 4.4: For laminating adhesive used in factory-laminated plastic panels, documentation indicating that product contains no urea formaldehyde.

C. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.3 PROJECT CONDITIONS

- A. Environmental Limitations:** Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations:** Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling:** Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product approved by the Architect.
2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 200 or less.
 - b. Smoke-Developed Index: 450 or less.
3. Nominal Thickness: Not less than 0.09 inch.
4. Surface Finish: As indicated by manufacturer's designations.
5. Color: As indicated by manufacturer's designations.

2.3 ACCESSORIES

- A. Trim Accessories:** Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: Match panels.
- B. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- C. Adhesive: As recommended by plastic paneling manufacturer and with a VOC content of 50 g/L or less.
- D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."
 1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, 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 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels and so that trimmed panels at corners are not less than 12 inches wide.
 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 1. Drill oversized fastener holes in panels and center fasteners in holes.
 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive. Do not fasten through panels.
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

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- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

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SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing to be utilized for the following:
 - a. Below grade brick.
 - b. Anchored stone, unexposed backs and sides.

1.2 ACTION SUBMITTALS

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

1.3 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.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.
- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, FIBERED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Euclid Chemical Company (The); an RPM company.
 2. Karnak Corporation.
 3. Meadows, W. R., Inc.

- B. Trowel Coats: ASTM D 1227, Type II, Class 1.

- C. ~~Fibred~~ Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

- ~~D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.~~

- E. VOC Content: 30 g/L or less.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

- ~~B. Emulsified Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.~~

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Coordinate work with Division 04 Sections "Unit Masonry" and "Anchored Stone Masonry Veneer".

3.4 BRICK

- A. Apply dampproofing to brick below grade not exposed to view.

3.5 ANCHORED STONE

- A. Apply dampproofing to unexposed backs and sides of stone. Coating shall be thoroughly cured prior to installation of stone.

3.6 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071113

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
2. ***Conference to be scheduled by General Contractor and include representatives of Owner, Contractor, Architects, Waterproofing Manufacturer, Foundation Firm, Installation Firm and Installers whose work interfaces with the waterproofing.***

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

C. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, fluid applied membrane air barrier, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

D. Samples: For each exposed product and for each color and texture specified, including the following products:

1. 8-by-8-inch square of waterproofing and flashing sheet.
2. 4-by-4-inch square of drainage panel.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
- B. Mockups: **Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance."** ~~Build mockups to verify selections made under Sample submittals and to set quality standards for installation.~~
 - ~~1. Build for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.~~
 - ~~a. Size: As indicated on Drawings.~~
 - ~~b. Description: Each type of wall installation.~~
 - ~~2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.~~
 - ~~3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.~~

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: Five years from date of **Substantial Completion of waterproofing system installation.**
- B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, molded-sheet drainage panels from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. American Hydrotech.
 - b. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
 - c. CETCO Building Materials Group, a subsidiary of AMCOL International Corp; Envirosheet.
 - d. Grace Construction Products; W.R. Grace & Co. -- Conn.; Bituthene 3000Bituthene 4000Bituthene Low Temperature.
2. Physical Properties:
- a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970/D 1970M.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836/C 836M.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E 154/E 154M.
 - f. Water Absorption: ~~0.2~~ **0.1** percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - g. Water Vapor Permeance: 0.05 perm maximum; ASTM E 96/E 96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.
- D. Substrate Patching Membrane: Non-shrink grout compatible with and approved by system manufacturer.
- E. Metal Termination Bars: Manufacturer's standard, predrilled at ~~98~~ **98**-inch centers, stainless-steel termination bars; approximately 1 by 1/8 inch thick; with stainless-steel anchors.

2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per foot.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Hydrotech, Inc.; Hydrodrain 400.
 - b. Carlisle Coatings & Waterproofing Inc; CCW MiraDRAIN 6200.
 - c. Grace Construction Products; W.R. Grace & Co. -- Conn.; Hydroduct 220.

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 waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Minimum cure and dry times:
 - a. Structural Concrete: 7 days.
 - b. Lightweight Concrete: 14 days.
 - 3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 - 1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- F. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
 - b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and per recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and 5-inch-minimum end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths, to provide a minimum of two thicknesses of sheet membrane over areas to receive waterproofing.
- E. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.
- F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- G. Seal edges of sheet-waterproofing terminations with mastic.
- H. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- J. Immediately install protection course with butted joints over waterproofing membrane.
 - 1. Molded-sheet drainage panels shall be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.4 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.5 FIELD QUALITY CONTROL

- A. ~~Testing Agency: Engage a qualified testing agency to perform tests. Testing and Inspecting:~~
 - 1. **Contractor will engage qualified, independent special inspectors and testing agency 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.**
 - 2. **Refer to "Testing Agency Qualifications" in "Quality Assurance" article in Part 1 - General above for testing agency requirements.**
 - 3. **Refer to "Field Quality Control" in Division 08 Section "Structural Sealant Glazed Curtainwalls" for testing requirements and areas to be tested on the building.**

- B. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.
- ~~C. **Flood Testing: Flood test each deck area for leaks, according to procedures in ASTM D 5957, after completing waterproofing but before placing overlying construction. Install temporary containment assemblies, plug or dam drains, and flood with potable water.**~~
- ~~1. **Flood to an average depth of 2 1/2 inches with a minimum depth of 1 inch and a maximum depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.**~~
 - ~~2. **Testing agency shall observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.**~~
 - ~~3. **After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.**~~
- ~~D. **Electronic Leak Detection Testing:**~~
- ~~1. **Testing agency shall test each deck area indicated for testing on Drawings for leaks using an electronic leak detection method that locates discontinuities in the waterproofing membrane.**~~
 - ~~2. **Testing agency shall perform tests on abutting or overlapping smaller areas as necessary to cover entire test area.**~~
 - ~~3. **Testing agency shall create a conductive electronic field over the area of waterproofing to be tested and electronically determine locations of discontinuities or leaks, if any, in the waterproofing.**~~
 - ~~4. **Testing agency shall provide survey report indicating locations of discontinuities, if any.**~~
- E. Test vertical surfaces and penetrations in vertical surfaces with a calibrated hose nozzle.
- F. Waterproofing will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- 3.6 PROTECTION, REPAIR, AND CLEANING
- A. Do not permit foot or vehicular traffic on unprotected membrane.
 - B. Protect waterproofing from damage and wear during remainder of construction period.
 - C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
 - D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
 - E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071326

SECTION 071413 - HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rubberized-asphalt waterproofing membrane, unreinforced.
2. Molded-sheet drainage panels.
3. Insulation.
4. Plaza-deck pavers supported on pedestals.
5. Continuous vegetated roof assemblies.

1.2 DEFINITIONS

- A. Captured Water: Water that is retained in the drainage layer of a vegetated roof assembly after new water additions have ceased and that cannot escape the roof except through evaporation or plant transpiration.
- B. Finish Elevation: Elevation of finished growing-media surface of planting area.
- C. Planting Area: Areas to be planted.
- D. Plant; Plants; Plant Material: Vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- E. Growing Medium: Manufactured, lightweight soil mixture that promotes good growing conditions for specific varieties of plants.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Review waterproofing requirements, including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include material descriptions for each growing medium.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.
 1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
 2. For each vegetated roof assembly.
 - a. Include plans, sections, slopes, and drain locations.
 - b. Indicate dimensions, weights, and loads.

- c. Detail field assembly of components, depth of growing media, and attachments to other work.

C. Samples:

- 1. For plaza-deck pavers in each color and texture required.
- 2. Growing Media: 1-quart volume of each growing medium, in sealed plastic bags labeled with content and source. Each Sample shall be typical of the lots of growing media to be furnished. Provide an accurate representation of texture and composition.
- 3. Moisture-Retention Mat: 12 by 12 inches.
- 4. Drainage Panels: 12 by 12 inches.
- 5. Root Barrier: 12 by 12 inches.
- 6. Separation Geotextile: 12 by 12 inches.
- 7. Soil Retainer: Manufacturer's standard size to verify configuration and color selected.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Mockups: Install waterproofing to 100 sq. ft. of deck to demonstrate surface preparation, crack and joint treatment, corner treatment, thickness, texture, and execution quality. Install pavers and paver supports to demonstrate aesthetic effects, and set quality standards for materials and execution.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.
- B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- C. Protect stored materials from direct sunlight.
- D. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and Federal laws if applicable.
- E. Bulk Materials:
 - 1. Do not dump or store bulk materials on or near structures, utilities, walkways and pavements, or existing roof areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of debris-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk materials with product certificates.

- F. Handle and store materials, and place equipment in a manner to avoid overloading roof structure or damaging roofing membrane.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below zero deg F.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pedestal-mounted pavers on plaza decks.
 - 2. Warranty insulation retains 80 percent of original published thermal value.
 - 3. Warranty pavers do not dish or warp and do not crack, split, or disintegrate in freeze-thaw conditions.
 - 4. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Installer's Warranty: Specified form signed by Installer, covering Work of this Section, for warranty period of two years.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pedestal-mounted pavers on plaza decks.
- C. Special Warranty for Vegetated Roof Assembly: Installer agrees to repair or replace components of vegetated roof assembly that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, ponding water or prolonged wetness of growing medium caused as a result of failure of the assembly to properly drain.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- D. Special Warranty for Plant Growth: 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, death and unsatisfactory growth except for defects resulting from abuse, lack of adequate maintenance, neglect by Owner, or incidents that are beyond Contractor's control.
 - 2. Warranty Period: From date of Substantial Completion as follows:
 - a. Ground Covers, Perennials, Vines, and Ornamental Grasses: Two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain waterproofing materials sheet flashings, protection course, molded-sheet drainage panels, insulation, pavers, and pedestals from single source from single manufacturer.

2.2 WATERPROOFING MEMBRANE

- A. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Monolithic Membrane 6125EV or comparable product approved by the Architect.

2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with waterproofing.
- B. Surface Conditioner: Asphaltic surface conditioner for concrete surfaces only.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Surface Conditioner or comparable product approved by membrane manufacturer and the Architect.
- C. Reinforcing: 60-mil thick, uncured neoprene (heavy duty) reinforcing sheet.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Flex Flash F or comparable product approved by membrane manufacturer and the Architect.
- D. Flashing: 60-mil (1.5 mm) thick, uncured neoprene sheet.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Flex Flash UN or comparable product approved by membrane manufacturer and the Architect.
- E. Adhesives/Sealant:
 - 1. Contact adhesive to bond elastomeric flashing together.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Splicing Cement or comparable product approved by membrane manufacturer and the Architect.
 - 2. Contact adhesive to bond elastomeric flashing to an approved substrate.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Bonding Adhesive or comparable product approved by membrane manufacturer and the Architect.
 - 3. Sealant to seal elastomeric flashing seam edge.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Lap Sealant or comparable product approved by membrane manufacturer and the Architect.
 - 4. Tape to bond laps of uncured neoprene flashings
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Seam Tape or comparable product approved by membrane manufacturer and the Architect.
- F. Separation/Root Barrier Protection Course: Combination of a fiberglass reinforced rubberized asphalt protection sheet and polyethylene root barrier.

1. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Hydroflex 30 and Root Stop HD or comparable product approved by membrane manufacturer and the Architect.
 - G. Prefabricated Drainage Course: Composite drainage system consisting of a three-dimensional, crush-proof, drainage core and a filter fabric.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Hydrodrain 300 or comparable product approved by membrane manufacturer and the Architect.
 - H. Insulation:
 1. Extruded polystyrene rigid board insulation for use above membrane.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company; STYROFOAM or comparable product approved by membrane manufacturer and the Architect.
 - b. Insulation shall meet ASTM C-578, Type VII.
 - c. Minimum compressive strength, ASTM D-1621, 60 psi
 - d. Maximum water absorption by volume per ASTM C-272, 0.3%
 - e. Water vapor permeance for 1 inch product per ASTM E-96, 0.8 perm (max.)
 - f. Insulation shall have an R value of 5.0°F ft² h/Btu/in. of thickness when tested at 75°F mean temperature in accordance with ASTM C-518
 - g. Product shall be free of CFC's
 2. Extruded polystyrene rigid board insulation for use as flat fill.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company; STYROFOAM or comparable product approved by membrane manufacturer and the Architect.
 - b. Insulation shall meet ASTM C-578, Type IV.
 - c. Minimum compressive strength, ASTM D-1621, 25 psi.
 - d. Maximum water absorption by volume per ASTM D-2842, 0.7%
 - e. Water vapor permeance for 1" product per ASTM E-96, 1.1 perm (max.)
 - f. Insulation shall have an R value of 5.0°F ft² h/Btu/in. of thickness when tested at 75°F mean temperature in accordance with ASTM C-518
 - g. Product shall be free of CFC's
 - I. Drainage/Water Retention Component: Three-dimensional, molded panels of recycled polyethylene with drainage channels top and bottom sides and water retention reservoirs top side.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Gardendrain GR50 or comparable product approved by membrane manufacturer and the Architect.
 - J. Filter Fabric: Non-woven, polymeric, geotextile fabric.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide American Hydrotech, Inc.; Systemfilter or comparable product approved by membrane manufacturer and the Architect.
- 2.4 PLAZA-DECK PAVERS**
- A. Plaza-Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged, manufactured for use as plaza-deck pavers; minimum compressive strength 6500 psi, ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Hanover Architectural Products.
 2. Thickness: 2 inches .
 3. Face Size: As indicated.
 4. Color: Custom as selected by Architect.
- B. Paver Supports: Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including adjustable or stackable pedestals, shims, and spacer tabs for joint spacing of 1/8 to 3/16 inch.

2.5 MISCELLANEOUS

- A. Metal Edging: Extruded aluminum edging perforated to allow water flow as shown on plans and details.
- B. Inspection Chambers: Aluminum and stainless steel over drain chambers perforated to allow water flow as shown on plans and details.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, and other voids.

3.3 JOINTS, CRACKS, AND TERMINATIONS

- A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.
 - 1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D 4258.
 - 2. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
 - 3. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.
 - a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.
- B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches on each side of joints and adhere to substrates in a layer of hot rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.

3.4 FLASHING INSTALLATION

- A. Install elastomeric sheets at terminations of waterproofing membrane according to manufacturer's written instructions.
- B. Prime substrate with asphalt primer.
- C. Install elastomeric sheet and adhere to deck and wall substrates in a layer of hot rubberized asphalt.
- D. Extend elastomeric sheet up walls or parapets a minimum of 8 inches above plaza-deck pavers and 6 inches onto deck to be waterproofed.

3.5 MEMBRANE APPLICATION

- A. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow it to dry.
- B. Heat and apply rubberized asphalt according to manufacturer's written instructions.
 - 1. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.
- C. Start application with manufacturer's authorized representative present.
- D. Unreinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. **~~Spread to form a uniform, unreinforced, seamless membrane, 180 mil (DFT) average thickness, but not less than 125 mils (DFT) thick. Provide continuous monolithic 90 mil minimum embed polyester reinforcing sheet. Apply a 125 mil minimum monolithic coat of membrane. Total membrane thickness 215 mil average, 180 mil minimum.~~**
- E. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.

3.6 **SEPARATION / PROTECTION COURSE** INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate according to manufacturer's written instructions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install board insulation before installing drainage panels.

3.7 **INSULATION** INSTALLATION

- A. Install one or more layers of board insulation to achieve required thickness over waterproofed surfaces. Cut and fit to within 3/4 inch of projections and penetrations.
- B. On vertical surfaces, set insulation units into rubberized asphalt according to manufacturer's written instructions.
- C. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.8 **PLAZA-DECK PAVER** INSTALLATION

- A. Install concrete pavers according to manufacturer's written instructions.
- B. Accurately install adjustable-height paver pedestals and accessories to elevations required. Adjust for final level and slope with shims.
- C. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Install pavers to not vary more than 1/16 inch in elevation between adjacent pavers or more than 1/16 inch from surface plane elevation of individual paver.
- E. Limit variation in paving installation to within 1/4 inch in 10 feet of surface plane in any direction; noncumulative.

3.9 **VEGETATED ROOF SYSTEM** INSTALLATION

- A. Protection Course: Cover roofing system with protection board with butted and fully taped joints before roofing system is subject to vegetated roof assembly installation work.
- B. Install root stop/protection board in compliance with manufacturer's written instructions to ensure waterproofing and flashings are completely protected.
- C. Install vegetated roof assembly according to manufacturer's written instructions.
- D. Small Plant Stabilization: Install erosion-control fabric over planting area to secure small plants according to manufacturer's written instructions.
- E. Access Boxes: Install access box at each drain, valve, and switch and at locations shown on Drawings. Install top of boxes level with the finish elevation of growing medium.
- F. Planting:
 - 1. Perform planting according to vegetated roof assembly manufacturer's written instructions.
 - 2. Do not place growing medium or plants during frozen, wet, or muddy conditions.

3. Suspend spreading, grading, and planting operations during periods of excessive moisture until the moisture content in growing medium reaches acceptable levels to attain the required results.
4. Uniformly moisten an excessively dry growing medium that is too dusty or unworkable.
5. Preplanted Vegetative Mat: Install in full contact with growing medium and secure in position.
6. Seeding Grasses: Sow seed at a total rate of 3 to 4 lb/1000 sq. ft..

3.10 FIELD QUALITY CONTROL

- A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; and application of membrane, flashings, protection, and drainage components; furnish daily reports to Architect.
 1. Site representative shall measure membrane thickness with pin tester or other suitable device at least once for every 100 sq. ft. and include measurements in reports.
- B. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, waterproofing application, protection, and drainage components, and to furnish reports to Architect.
- C. Flood Testing: Flood test each deck area for leaks, according to procedures in ASTM D 5957, after completing waterproofing but before placing overlying construction. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and a maximum depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
 2. Testing agency shall observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.
 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

3.11 CLEANING AND PROTECTION

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071413

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SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board.
 - 2. Mineral-wool board insulation.
 - 3. Mineral-wool blanket insulation.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Data: For adhesives, indicating VOC content.

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 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 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 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 INSULATION

- A. Extruded Polystyrene Board, Type VI For Vertical Applications: ASTM C 578, Type VI, 40-psi minimum compressive strength; 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.
- B. Extruded Polystyrene Board, Type VII For Horizontal Applications: ASTM C 578, Type VII, 60-psi minimum compressive strength; 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.

2.2 MINERAL-WOOL BOARD INSULATION

- A. Unfaced Mineral-Wool Board Insulation : ASTM C 612, Type III; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 8 lb/cu. ft..
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Roxul Inc.
 - b. Thermafiber, Inc.; an Owens Corning company.
- B. Faced Mineral-Wool Board : ASTM C 612, Type III; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84. Nominal density of 8 lb/cu. ft..
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Roxul Inc.
 - b. Thermafiber, Inc.; an Owens Corning company.

2.3 MINERAL-WOOL BLANKET INSULATION

- A. Unfaced, Mineral-Wool Blanket Insulation : ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Roxul Inc.
 - b. Thermafiber, Inc.; an Owens Corning company.
- B. Reinforced-Foil-Faced, Mineral-Wool Blanket Insulation : ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); 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. Thermafiber, Inc.; an Owens Corning company.

2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
 - b. Gemco; Spindle Type.
 - 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Insulation-Retaining Washers : Self-locking washers formed from 0.016-inch- 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 square or in diameter.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGM Industries, Inc.; SC150.
 - b. Gemco; S-150.
 - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Ceiling plenums.
 - b. Where indicated.
- C. Anchor Adhesive : Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. AGM Industries, Inc.; TACTOO Adhesive.
 - b. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing 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 indicated.
- 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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 36 inches in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

- A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
 - 2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
 - 3. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.6 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.
 - 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
 - 2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

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SECTION 072600 - UNDER SLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vapor barrier, seam tape, and mastic for installation under concrete slabs.

1.2 REFERENCES

A. American Society of Testing and Materials (ASTM):

1. ASTM E 1745-09 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
2. ASTM E 154-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM F 1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
5. ASTM E 1643-09 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

A. Product Data: Provide physical properties.

B. Quality Assurance:

1. Summary of test results as per paragraph 8.3 of ASTM E 1745.
2. Manufacturer's samples, literature.
3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.

C. Manufacturer Certification: for Installation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm acceptable to the manufacturer for installation of specified products.**

1.5 DELIVERY STORAGE AND HANDLING

- A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.**
- B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by the manufacturer.**
- C. Remove and replace materials that cannot be applied within their stated shelf life.**
- D. Protect stored materials from direct sunlight. Do not expose materials vulnerable to water or sun damage in quantities greater than can be installed the same day.**

- E. Store materials within temperature ranges recommended by product manufacturers.

1.6 WARRANTY

- A. Manufacturer warrants the product will perform to meet the specified reference standards.
- B. Manufacturer will visit Project site to inspect the work and certify the installation meets their recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- 1. Basis of Design: Subject to compliance with requirements, provide Stego Wrap Vapor Barrier 15-mil by Stego Industries LLC or one of the following comparable products:
 - a. Premolded membrane by W.R. Meadows.
 - b. VaporGuard by Reef Industries, Inc.
- B. Vapor barrier must have all of the following qualities:
 - 1. Permeance of less than 0.01 perms when tested in accordance with ASTM E 1745 Section 7.
 - 2. Strength: ASTM E 1745 Class A.
 - 3. Thickness: 15 mils minimum.
 - 4. Provide tape, mastic, and other accessories recommended by the manufacturer. All system components shall be from the same manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Ensure that base material is approved by the Architect and Geotechnical Engineer.
 - 1. Level and compact base material.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643.
 - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.
 - 2. Lap vapor barrier over footings and/or seal to foundation walls.
 - 3. Overlap joints 6 inches and seal with manufacturer's tape.
 - 4. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
 - 6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION 072600

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vapor-retarding, fluid-applied air barriers to act as liquid drainage plane – direct condensation and moisture to exterior at flashing.
2. Application of materials to provide bridge and seal air leakage pathways in:
 - a. Wall and roof connections and penetrations.
 - b. Connections to foundation walls.
 - c. Walls, windows, curtain walls, storefronts, louvers or doors
 - d. Expansion and control joints.
 - e. Masonry ties, screws, bolts, and similar penetrations.
 - f. Conduit, piping and ducts.
 - g. All other penetrations or other air leakage pathways through the wall assembly.

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.
- D. ABAA: Air Barrier Association of America.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Participants: Owner, Architect, Envelope Consultant, Contractor, air barrier installer, air barrier manufacturer's representative, and installers whose work interfaces with or affects air barrier.
2. Agenda:
 - a. 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) Include review of penetrations, building deflection joints, and other construction affecting air barrier installation.
 - b. Review methods, procedures, and construction sequence for air barrier and related construction, including review of manufacturer's written product specifications and installation instructions.
 - 1) Review requirements for coordination of air barrier with adjacent materials and construction.
 - c. Review substrate conditions and finishes required to comply with manufacturer's requirements for installation of air barrier including fastening and flatness of substrate.

- d. Coordinate with work of other trades. Verify compatibility of materials in contact with each other, sealants, waterproofing, etc.
3. Air Barrier Manufacturer's Acceptance: Obtain manufacturer's acceptance of air barrier for intended use shown on Drawings and of compatibility of air barrier with all materials in contact with air barrier.

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. Sustainable Design Submittals:
 1. Product Data: For coatings, indicating VOC content.
- C. 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 including, but not limited to, the following as applicable to this Project:
 - a. Connection of air barrier in walls to roof membrane.
 - b. Connection of air barrier in walls to waterproofing at foundation.
 - c. Application of air barrier to seismic and expansion joints.
 - d. Application of air barrier to openings and penetrations by windows, storefront framing, curtain wall framing, door frames, piping, conduit, ducts, masonry ties, screws, bolts, and similar components and penetrations.
 - e. Application of air barrier to precast concrete and other types of exterior wall construction.
- D. Samples: Submit minimum 3-inch by 4-inch samples of each air barrier material, clearly labeled to indicate material and use in air barrier system.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
 1. Submit evidence that Installer is currently accredited under ABAA Quality Assurance Program, including accreditation number for ABAA Certified Installers.
- B. Certifications
 1. 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.
 2. Acceptance of Materials: Submit document from air-barrier manufacturer certifying acceptance of materials proposed for use with air barrier that are not specified in this Section.
 3. Substrate Compatibility: Submit document from air-barrier manufacturer certifying that air barrier system materials used to adhere air barrier to substrate are chemically compatible.
 4. ABAA Certification: Submit evidence that air barrier system complies with requirements of ABAA Quality Assurance program specified in Quality Assurance article in this Section.

- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field Quality-Control Reports: Submit test results from testing specified in Field Quality Control article in Part 3 of this Section.
- E. ABAA QAP Report: Submit copy of ABAA Quality Assurance Program Report.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project. Refer to ABAA web site for current listing of ABAA accredited installers.
- B. **(Alternate Pricing)** ABAA Quality Assurance Program: Comply with requirements of ABAA Quality Assurance Program and cooperate with ABAA inspectors and independent testing and inspection agencies engaged by Owner. Do not permit covering of air barrier system until after inspection, testing, and acceptance by ABAA inspectors and testing and inspection agencies.
 - 1. Refer to Air Barrier Association of America (ABAA) web site for listing of contractors complying with this requirement (www.airbarrier.org).
- C. Mockups: **Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance." Test mockups in accordance with Division 08 Section "Structural Sealant Glazed Curtainwall." ~~Build mockups to set quality standards for materials and execution.~~**
 - ~~1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, 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 and testing of air barrier before external insulation and cladding are installed.~~
 - ~~1) Test in accordance with ASTM E783 and E1105.~~
 - ~~b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.~~
 - ~~c. 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.~~
 - ~~3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.~~

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.
- B. VOC Content: 250 g/L or less.

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.
 1. Movement/Control Joints: Provide air barrier assembly capable of accommodating movements of building and building materials, including providing expansion and control joints and applicable accessories required to accommodate these movements.
 - a. Provide air barrier assembly capable of withstanding combined design wind, fan, and stack pressures, positive and negative, on building envelope without damage or displacement and transferring loads to structure.
 - b. Provide air barrier assembly materials that do not displace adjacent materials and air barrier assembly materials under full load.
 - c. Provide air barrier assembly joined in airtight and flexible manner to air barrier materials incorporated into adjacent construction and that allows relative movement of assemblies due to thermal and moisture variations, creep, and anticipated seismic movement.
 2. Connections to Adjacent Materials: Provide connections to adjacent materials that prevent air, condensation and water drainage leakage at following locations:
 - a. Foundation and walls, including penetrations, ties and anchors.
 - b. Walls, windows, curtain walls, storefronts, louvers and doors.
 - c. Different assemblies and fixed openings within those assemblies.
 - d. Wall and roof connections.
 - e. Floors/soffits over unconditioned space.
 - f. Walls, floor and roof across construction, control and expansion joints.
 - g. Walls, floors and roof to utility, pipe and duct penetrations.
 - h. Seismic and expansion joints.
 - i. All other potential air, condensation and water drainage leakage pathways in building envelope.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.
- C. Drawings show continuity of vapor-retarding membrane air barrier. Manufacturer and installer are to verify all transitions, movement and penetrations are sealed air tight.

2.3 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

- A. High-Build, Vapor-Retarding Air Barrier: synthetic polymermembrane with an installed dry film thickness, according to manufacturer's written instructions, of 40 mils or thicker over smooth, void-free substrates.
 - 1. Synthetic Polymer Type:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc; Fire Resist Barritech NP.
 - 2) Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier Liquid.
 - 3) W. R. Meadows, Inc; Air-Shield LSR.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Maximum 0.1 perm; ASTM E 96/E 96M, Desiccant Method.
 - c. Ultimate Elongation: Minimum 1000 percent; ASTM D 412, Die C.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - f. UV Resistance: Can be exposed to sunlight for minimum of 90 but not exceeding 180 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: Low VOC liquid waterborne or solvent-borneprimer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.
- D. Flexible flashing.

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 substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints, expansion joints, and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form 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 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 and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.

2. Refer to Division 08 sections for entrances and storefronts and curtain walls for transition assemblies for concealed perimeter frame surfaces for entrances and storefronts and curtain walls.
 - F. At each penetration of the air/vapor barrier, provide at a minimum, self healing peel and stick transition strip compatible with installed air/vapor barrier system.
 1. In addition, provide independent testing which demonstrates that penetration through air/vapor barrier does not compromise properties of the barrier.
 - G. Provide continuous self adhered sheet flashing at all horizontal surfaces, including but not limited to under copings and at ledges.
 - H. Fill gaps in perimeter frame surfaces of windows and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
 - I. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
 - J. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide minimum (or as required by manufacturer), transition strip to ensure barrier is weather tight.
 - K. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
 - L. 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, minimum, 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 all penetrations and protrusions such as masonry ties and anchors.
 1. Vapor-Retarding, 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, 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. ***Provide Alternate pricing to have*** ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
 - B. Testing Agency: ~~Owner will engage a qualified testing agency to perform tests and inspections.~~

- ~~1. Cooperate with Owner's testing agency, allowing Owner's testing agency access to work areas and staging and notifying Owner's testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection by Owner's testing agency. Do not cover Work of this section until testing and inspection by Owner's testing agency has been completed and accepted.~~
 2. Contractor will engage qualified, independent special inspectors and testing agency 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.
 3. Refer to "Testing Agency Qualifications" in "Quality Assurance" article in Part 1 - General above for testing agency requirements.
 4. Refer to "Field Quality Control" in Division 08 Section "Structural Sealant Glazed Curtainwalls" for testing requirements and areas to be tested on the building.
- C. **(ALTERNATE PRICE)** ABAA Installer Testing and Audits: Cooperate with ABAA testing agency, allowing ABAA testing agency access to work areas and staging and notifying ABAA testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection by ABAA testing agency. Do not cover Work of this section until testing and inspection by ABAA testing agency has been completed and accepted.
1. Cost of ABAA Testing and Audit: Arrange and pay for site inspections and testing by ABAA to verify conformance of air barrier with specified requirements, air barrier system manufacturer's installation instructions, and ABAA Site Quality Assurance Program.
 2. Extent of Audit and Testing: Provide audit and testing as follows:
 - a. Up to 10,000 sq. ft. (929 sq. m.): 1 audit/test.
 - b. 10,001 to 35,000 sq. ft. (929.1 to 3251.6 sq. m.): 2 audits/tests.
 - c. 35,001 to 75,000 sq. ft. (3251.7 to 6967.7 sq. m.): 3 audits/tests.
 - d. 75,001 to 125,000 sq. ft. (6967.78 to 11612.8 sq. m.): 4 audits/tests.
 - e. 125,001 to 200,000 sq. ft. (11612.9 to 18580.6 sq. m.): 5 audits/tests.
 - f. 200,001 sq. ft. (18580.7 sq. m.) and over: 6 audits/tests.
 3. Reporting: Submit written audit/testing reports to Architect within 10 working days of date inspection and testing performed.
 4. Correction: If audit and testing reveals defects, promptly remove and replace defective air barriers at no additional cost to Owner.
- D. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements.
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 of condensation/water drainage (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.

~~E. Tests: As determined by testing agency from among the following tests:~~

- ~~1. Air Leakage Volume Testing: Air barrier assemblies will be tested for air leakage rate according to ASTM E 783.~~**
- ~~2. Adhesion Testing: Air barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.~~**

- F. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- G. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- H. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

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SECTION 074243 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Metal composite material wall panels, including mounting system and associated components required for complete vertical rainscreen system.
2. Coping system (wet seal) where indicated.
3. Column covers, soffits, sills, border and filler components integral to complete panel system and as indicated on Drawings.
4. ***Blank off panel to be installed in curtain wall system adjacent to doors as indicated on the drawings.***

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel installer, metal composite material panel manufacturer's representative, structural-support installer, and installers whose work interfaces with or affects metal composite material panels, including, but not limited to, installers of supporting construction, air barrier, 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 composite material 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 composite material panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
2. Include manufacturer's physical characteristics for all components of metal composite material wall panel system as shown on Shop Drawings.

B. LEED Submittals

1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content; include statement indicating costs of each product having recycled content.

- C. Shop Drawings: Submit shop drawings prepared by, or under supervision of, Structural Design Engineer as specified in Quality Assurance article below and including Structural Design Engineer's stamp or seal on all shop drawings including system attachments and anchors.
 - 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.
 - a. Identify factory-assembled and field-assembled work.
 - b. Show substrates receiving metal composite material wall panel system and adjacent construction requiring coordination with metal composite material wall panel system installation.
 - c. Include details showing integration of metal composite material wall panel system with air barrier system.
 - d. Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
 - 2. Submit computer-generated drawings; manually-prepared drawings not acceptable.
- 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 actual panel width. Include fasteners, closures, and other metal composite material panel accessories.
- E. Delegated Design: Submit structural analysis of metal composite material wall panel system demonstrating compliance with specified design loading with signature and seal of Structural Design Engineer as specified in Quality Assurance article below.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Submit certification and supporting information indicating compliance with requirements specified in Quality Assurance article below for following:
 - 1. Installer.
 - 2. Fabricator.
 - 3. Structural design engineer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field Quality-Control Reports: Submit following reports:
 - 1. Results of tests conducted on mockups.
 - 2. Metal composite material wall panel manufacturer's field reports indicating what was observed and what changes were requested or required by manufacturer. Submit within 48 hours after manufacturer's field observations.
 - 3. Inspection reports and letters from air barrier installer and metal composite material wall panel manufacturer indicating acceptance of conditions where panel system is to be installed. Submit report and letter prior to starting panel system installation.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer: Provide representation by manufacturer's field representative during construction and provide written acceptance of installer and fabricator.

2. Installer: An entity specializing in installation of metal composite material wall panel systems that employs installers and supervisors who trained and approved by metal composite material wall panel manufacturer with minimum 3 years documented experience in installing metal composite material wall panel system similar in nature and scope to system to be installed as part of this Project.
 3. Fabricator: An entity specializing in fabrication of specified metal composite material wall panel components as indicated for installation as part of this Project and who is acceptable to metal composite material wall panel manufacturer.
 4. Structural Design Engineer: Qualified professional structural engineer licensed in state where Project is located and experienced in design of metal composite wall panel systems responsible for design of structural support and anchorage for metal composite material wall panel system as shown on Drawings.
- B. Single Source: Obtain metal composite material wall panels and related components from single manufacturer.
- C. Mockups: **Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance." Test mockups in accordance with Division 08 Section "Structural Sealant Glazed Curtainwall." Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.**
- ~~1. Build mockup of typical metal composite material panel assembly as shown on Drawings, including corner, soffits, supports, attachments, and accessories. Include substrate construction with air barrier system as installed on Project.~~
 - ~~2. Testing: Conduct following testing of mockups after cladding support system is installed, but prior to panel installation:~~
 - ~~a. Water Spray Test: Conduct water spray test of mockup of metal composite material panel assembly, testing for water penetration according to AAMA-501.2.~~
 - ~~b. Air and Water Tightness: Conduct testing of area in mockup containing panel anchors penetrating air barrier for air and water tightness in accordance with performance and testing requirements specified in Division-07 air barrier sections of Project Manual.~~
 - ~~3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.~~
 - ~~4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.~~
- D. Sample Panels: **Construct sample panels in accordance with Division 01 Section "Quality Assurance."**
- 1.7 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.

1.8 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.
- B. Field Measurements: Take field measurements prior to completion of shop fabrication of metal composite material wall panels. Coordinate panel fabrication schedule with construction progress schedule as established by Contractor to avoid delay of construction.
- C. Field Modification: Metal composite material wall panels may be modified in field as required to ensure proper fit as acceptable to panel manufacturer and Architect. Keep field modifications to absolute minimum, ensuring majority of fabrication accomplished under manufacturer and fabricator controlled conditions.

1.9 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, coping system, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- B. Coordinate metal composite material panel system installation in manner to ensure integrity of air barrier system is not disrupted. Provide monitoring and inspection of metal composite material panel system installation by air barrier system installer and manufacturer's representative.

1.10 WARRANTY

- 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.
 - 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.
 - 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. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
 - 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.

- 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.

- 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

- A. Metal Composite Material Wall Panel Systems - Extruded Thermoplastic Core: 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, panel stiffeners, and accessories required for complete rainscreen system. Provide system where panels anchored to supporting construction without exposed fasteners.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3A Composites USA, Inc.; Alucobond.
 - b. Alcoa Inc.; Reynobond PE.
 - c. ALPOLIC, Division of Mitsubishi Chemical America, Inc.; ALPOLIC
 - 2. Fabricators: Basis-of-Design Fabricator: Subject to compliance with the requirements, provide Universe Corporation 2000r "rainscreen" Attachment System.
 - 3. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- thick, coil-coated aluminum sheet facings.
 - a. Panel Thickness: 0.157 inch .
 - b. Core: Standard.
 - c. Exterior Finish: Three-coat custom metallic fluoropolymer.
 - 1) Color: Basis of Design Color: Reynobond Colorweld 500 "Pewter".
 - 4. Attachment Assembly Components: Formed from extruded aluminum.
 - 5. Attachment Assembly: Manufacturer's standard rainscreen principle system.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, 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.
 - 1. Rain Screen Wall Assemblies: Provide complete support framing and attachment system for installation of rain screen wall assemblies resulting in continuous insulated wall assembly when combined with insulation and cladding that is thermally isolated from structural wall framing by thermal spacers. Include consideration for drainage requirements of compartments for pressure-equalized rain screen assembly.
 - 2. Thermal Spacers: Refer to Section 074800 - Cladding Support Systems for thermal spacers.
- B. Panel Accessories for Copings: 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:

1. Provide flashing and trim formed from same material as metal composite material panels in not less than 0.050-inch thickness unless otherwise indicated as required to seal against weather and to provide finished appearance.
2. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers.
3. Finish flashing and trim with same finish system as adjacent metal composite material panels.
4. Provide lap strap under flashing where flashing abut adjoining construction and seal lapped surfaces with full bed of non-hardening sealant.

D. Fasteners:

1. Exposed Fasteners: Stainless steel; not acceptable unless ~~acceptable to~~ **approved by the Architect**.
2. Screws: Self-tapping or self-drilling Type 410 stainless steel screws designed to withstand design loads and provided with EPDM or PVC sealing washers under heads of exposed fasteners and bearing on weather side of metal composite material wall panels.
3. Bolts: Stainless steel.
4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.

- E. Panel Sealants: ASTM C 920; elastomeric 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.
- B. Panel Fabrication: Fabrication panels with ~~1 2-1/4~~ 2-1/4-inch deep pans formed from metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
1. Fabricate metal composite material 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.
 2. Reinforce corners with riveted aluminum angles.
 3. Provide concealed attachment to supporting structure by adhering attachment members to back of panel. Attachment members may also function as stiffeners.
 4. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length. Provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
 5. Secure members to back face of panels using structural silicone sealant approved by metal composite material sheet manufacturer.
 6. Fabricate panels under controlled shop conditions.
 7. Fabricate as indicated on Drawings and as recommended by metal composite material sheet manufacturer.
 - a. Make panel lines, breaks, curves and angles sharp and true.
 - b. Keep plane surfaces free from warp or buckle.
 - c. Keep panel surfaces free of scratches or marks caused during fabrication.
 8. Provide joint details that provide watertight and structurally sound wall panel system not allowing uncontrolled water penetration on inside face of panel system.
 9. "Dry" Jointing: Secure extrusions to returned pan edges with stainless steel rivets, and provide means of concealed drainage with baffles and weeps for water accumulating in system members.

- C. 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 non-expansion, 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.

2.5 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. Aluminum Panels and Accessories:
 - 1. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes 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 composite material panel supports, and other conditions affecting performance of the Work.
 - 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.
 - 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 C 754 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 fastenings 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.
- 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.
- 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.
 - 2. Air Barrier: After installation of attachment assembly and prior to installing metal composite material wall panels and at no additional cost to Owner, provide following:
 - a. In accordance with recommendations of air barrier manufacturer and as directed by air barrier installer, seal penetrations in air barrier created by screws used to secure wall panel system support structure as required to ensure air barrier warranty is not compromised.

- b. In accordance with recommendations of air barrier manufacturer and as directed by air barrier installer, seal holes or tears in air barrier created by installation of metal composite material wall panels as required to ensure air barrier warranty is not compromised.
 - c. After repairs to air barrier system, retest air barrier system for air and water tightness in accordance with requirements in Section where applicable air barrier is specified and submit field reports of all testing demonstrating compliance with requirements specified in Section where applicable air barrier is specified.
 - d. Prior to proceeding with metal composite material wall panel installation:
 - 1) Repeat repair and testing process until testing results comply with requirements specified in Section where applicable air barrier is specified as acceptable to Architect.
 - 2) Arrange for inspection of all repairs to air barrier by air barrier manufacturer and air barrier installer and obtain written acceptance of air barrier system with repairs.
 - 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. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.
 - 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 composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material 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 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 result in 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).
- 3.4 ERECTION TOLERANCES
- A. Installation Tolerances: Install metal composite material wall panels square, plumb, straight, and true, accurately fitted with tight joints and intersections maintaining following tolerances:
 - 1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
 - 2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
 - 3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
 - 4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: ~~a qualified independent testing agency to perform field tests and inspections.~~
1. *Contractor will engage qualified, independent special inspectors and testing agency 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.*
 2. *Refer to "Testing Agency Qualifications" in "Quality Assurance" article in Part 1 - General above for testing agency requirements.*
 3. *Refer to "Field Quality Control" in Division 08 Section "Structural Sealant Glazed Curtainwalls" for testing requirements and areas to be tested on the building.*
- ~~B. Water Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.~~
- ~~C. Manufacturer's Field Service: Engage a factory authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.~~
- ~~D. Metal composite material 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 composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 074646 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fiber-cement siding.

1.2 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper installation and sequencing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. 12-inch- long-by-actual-width Sample of siding.
 - 2. 12-inch- long-by-actual-width Samples of trim and accessories.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish full lengths of fiber-cement siding including related accessories, in a quantity equal to 2 percent of amount installed.

1.7 QUALITY ASSURANCE

- A. Mockups: **Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance." Test mockups in accordance with Division 08 Section "Structural Sealant Glazed Curtainwall." Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.**
 - ~~1. Build mockup of typical wall area as shown on Drawings.~~
 - ~~2. Build mockups for fiber cement siding including accessories.~~
 - ~~a. Size: 48 inches long by 60 inches high.~~
 - ~~b. Include outside corner on one end of mockup and inside corner on other end.~~
 - ~~3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.~~
 - ~~4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.~~

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Swiss Pearl Carat SL, black opal 7021.
- B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 **PHYSICAL AND MECHANICAL PANEL PROPERTIES**

- A. **Density 1.8 g / cm³ (as per ASTM C 1186)**
- B. **Color change (as per ASTM G 155-05)**
 - 1. **2000 hours: Change in E ≤ 1.9 (approx. equivalent of 5 yrs exposure)**
 - 2. **5000 hours: Change in E ≤ 2.1 (approx. equivalent of 13 yrs exposure)**
- C. **Fire resistance (as per ASTM E-84, E-136 and NFPA 285)**
 - 1. **Flame spread index: 0**
 - 2. **Smoke developed index: ≤ 15**
 - 3. **No flaming after 30 sec. weight loss ≤ 50%, final center temp. ≤ 30°C**
- D. **Fire classification: UBC Class I, NFPA Class A**
- E. **Frost resistance (as per ASTM C 1185-95): 2944 psi / 20.3 MPa**
- F. **Minimum strength and bending characteristics (as per ASTM C 120 / C 1185-95)**
 - 1. **Modulus of rupture 24 MPa / 24 N/mm² (average cross/length)**
 - 2. **Modulus of elasticity 16 GPa / 16 kN/mm²**
- G. **Moisture properties (as per ASTM C 1185-95)**
 - 1. **Moisture content normal 6 percent (by mass)**
 - 2. **Moisture content maximum 20 percent (by mass)**

- H. Water tightness: No visible droplets or surface wetting (ASTM C 1185-95)*
- I. Coefficient of thermal expansion: $10 \times 10^{-6} K^{-1}$ (as per ASTM E 228-95)*
- J. Guaranteed to be free from efflorescence proven by referenced projects a minimum of 5-10 years old*
- K. Wind load testing for up to 63 PSF Design Pressure Ratio per TAS 203-94 test standards (Miami Dade Building Code) or ASTM E330-02 test standards*

2.4 FRC PANEL CHARACTERISTICS

- A. Panels shall be made from:*
 - 1. Portland cement, ground lime stone, additives*
 - 2. Polyvinyl alcohol fibers and cellulose fibers*
 - 3. Acrylic coating to panel face, rear side and edges*
- B. The following characteristics are not acceptable:*
 - 1. Autoclaved product*
 - 2. Reinforcement with only cellulose fibers*
 - 3. Efflorescence*
- C. FRC panels shall be air cured for at least 4 weeks*

2.5 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.*
 - 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.*
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:*
 - 1. Door and window casings.*
 - 2. Fascia.*
 - 3. Moldings and trim.*
- C. Flashing: Provide ~~aluminum~~ stainless steel flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.*
 - ~~*1. Finish for Aluminum Flashing: High-performance organic finish.*~~
- D. Fasteners:*
 - ~~*1. For fastening to metal, use ribbed bugle head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw threads, into substrate.*~~
 - ~~*2. For fastening fiber cement, use stainless steel fasteners.*~~
 - 3. Supplied by panel manufacturer and installed per manufacturer's written instructions*
 - a. Rivets 4.0 x 18.0 mm, 15 mm head (for metal sub frame) exposed fasteners*
 - b. Sigma 8 concealed fastener system*

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and related accessories.*
- B. Proceed with installation only after unsatisfactory conditions have been corrected.*

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
 - 2. Install fasteners no more than 24 inches o.c.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074646

SECTION 074800 – CLADDING SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cladding support systems for cladding systems specified in Division 07 Sections:
 - a. Fiberglass clip system.
 - b. Aluminum “Z” girts and angles.

1.2 ACTION SUBMITTALS

- A. Product Data: For each product.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For cladding support system, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Trained and authorized by manufacturer as qualified to install work of this Section.
2. Able to show successfully completed projects of equivalent scope and quality upon request by Architect.

B. Mock-Ups: ***Construct mockups in accordance with this Section and Division 01 Section “Quality Assurance.” Test mockups in accordance with Division 08 Section “Structural Sealant Glazed Curtainwall.” Build mockups to verify selections made, to demonstrate aesthetic effects, and to set quality standards for materials and execution.***

- ~~1. Mock up complete cladding support system at location as directed by Architect.~~
- ~~2. Include substrate, air barrier, insulation, framing, flashing, thermal isolation, and treatments at fenestrations, corners, and transitions.~~
- ~~3. Verify mock-up as conforming to manufacturer’s instructions and provisions of Contract Documents.~~
- ~~4. Do not begin work of this Section until after inspection by manufacturer’s representative is complete and mock-up has been accepted in writing by Architect.~~
- ~~5. Approval of mockups is for 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 such deviations are specifically approved by Architect in writing.~~
- ~~6. Approved mock-ups may be incorporated into the work of this Section.~~

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design cladding support system.

- B. General Performance: Comply with performance requirements specified, representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Cladding support system shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - a. Align cladding support system movement joints with substrate movement joints, unless otherwise noted.
 - 2. Failure includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Loosening or weakening of fasteners, attachments, and other components.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Dead Loads: As indicated on Drawings.
 - 3. Other Design Loads: As indicated on Drawings.
- D. Allowable Fastener Loads: Coordinate with substrate and framing systems to determine fastener types and sizes, and required minimum thicknesses of substrate framing members required for screw pull-out resistance.
- E. Design cladding support system to coordinate and align with substrate framing system specified in Division 05, and cladding system specified in Division 07.
- F. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. As required by manufacturer of materials supported by cladding support system.
- G. Seismic Performance: Cladding support system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.2 CLADDING SUPPORT SYSTEMS

- A. Fiberglass Clip System (FCS): Cladding support system consisting of fiberglass thermal spacer and steel Z girts.
 - 1. Thermal Spacer: Low conductivity thermal spacer; 4 inches deep.
 - a. Basis-of-Design Product: Subject to compliance with the requirements, provide "Cascadia Clip" by Cascadia Windows and Doors, or comparable product.
 - 2. Aluminum Z Girts and Angles: Minimum 0.030 inch thick mill finished.

2.3 Size: 1-1/2 by 1 by 1-1/4 inches .FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Screw Fasteners: Provide stainless steel screw fasteners.
 - 1. Minimum No. 14 self-drill hex-head screw fastener to be used to attach horizontal rail to vertical rail.
 - 2. Steel Studs:
 - a. Self-drill hex-head TEK screw fasteners of sufficient length.
 - b. Minimum three threads must penetrate steel stud members.

2.4 MISCELLANEOUS MATERIALS

- A. Bracing, Furring, Bridging, Plates, Gussets, and Clips: Formed sheet steel, thickness as required to meet structural requirements for special conditions encountered.
- B. Sealants: Comply with Division 07 Section "Sealants," and with requirement of air barrier system manufacturer's instructions for compatibility.
- C. Galvanic Protection: Utilize tapes and other methods as required to separate and prevent contact between dissimilar metals.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify conditions ready to receive work of this Section before starting.
- B. Substrate: Verify substrate is level and plumb, free of defects, and conforming to tolerances suitable for installation of subsequent work.
- C. Air Barrier System: Verify complete, cured, and conforming to manufacturer's instructions. Verify fenestrations, transitions, discontinuities, and sills and ledgers flashed and sealed to move moisture to exterior of building as part of air barrier system.
 - 1. Coordinate compatibility of all cladding support system materials and accessories with air barrier system.

3.2 PREPARATION

- A. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.
- B. Shim and perform work as required for plumb and true alignments.

3.3 INSTALLATION

- A. Set cladding support system to required levels and lines, with members plumb, true to line, cut, and fitted, and aligned to attachment requirements of cladding system. Fit member shapes to other construction; scribe and cope as needed for accurate fit.
- B. Fiberglass Clip System: Install in strict compliance with manufacturers written directions.
 - 1. Spacing: Install fiberglass thermal spacers at each stud location, and as required by Performance Requirements, but not more than 24 inches on center, horizontally and at no more than 26 inches on center vertically.
 - 2. Insert continuous steel Z girts into fiberglass thermal spacers and anchor to substrate as directed by manufacturer. Where indicated, provide horizontal hat-shaped channels in lieu of, or in addition to Z girts, and anchor as directed by manufacturer. Provide vertical or horizontal girt orientation as required by cladding system.
 - 3. At each penetration of the air/vapor barrier, provide, self healing peel and stick transition strip compatible with installed air/vapor barrier system.
 - a. In addition, provide independent testing which demonstrates that penetration through air/vapor barrier does not compromise properties of the barrier.

3.4 ERECTION TOLERANCES

- A. Maximum Framing Member Variation from True Position: 1/8 inch .
- B. Maximum Framing Member Variation from Plane:
 - 1. Individual Framing Members: Do not exceed 1/8 inch in 10 foot .

2. Cumulative Over-all Variation for System: Do not exceed 1/8 inch .

3.5 AIR BARRIER SYSTEM REPAIR

- A. Seal all penetrations in substrate air barrier system created by the installation of cladding support systems, including, but not limited to fastener installation, tears, holes, and abrasions, in accordance with the air barrier system manufacturers instructions.

3.6 FIELD QUALITY CONTROL FOR CLADDING SUPPORT SYSTEM

- A. Manufacturer's Field Technical Service: Provide intermittent and final inspection to verify installation in conformance to manufacturer instructions and suitable as framing assembly for specified cladding systems.
 1. Confirm torque tightness and fastener sizing.
 2. Confirm framing members installed in correct orientation and location.
 3. If testing of air barrier system at mock-up is required by other Sections, coordinate installation of cladding support systems with air barrier system installation, inspection, and testing.
 - a. Install cladding support system prior to inspection and testing of air barrier system.
 - b. If inspections reveal any defects, promptly remove and replace, or repair at the approval of the Architect, defective work at no additional expense to the Owner, until testing results are satisfactory.

3.7 ADJUSTING AND PROTECTION

- A. Inspect and adjust after installation.
- B. Adjust, and reconfigure as required to accommodate cladding systems for installations over work of this Section. Do not reuse pre-drilled holes unless fastener size is increased.
- C. Protect cladding support system from damage during work. Replace damaged components and materials as directed by the Architect.

END OF SECTION 074800

SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fully adhered EPDM membrane roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.

1.2 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.
- B. Roofing System: Includes all materials, components, accessories and equipment required by roofing system manufacturer to provide specified warranty for applications shown on Drawings.

1.3 PREINSTALLATION MEETINGS

- A. Pre-Installation 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, insulation 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 will affect 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 indicated, including roofing system manufacturer's specifications and installation instruction and data substantiating compliance with specified requirements.
- B. LEED Submittals:
 - 1. Product Data: For adhesives and sealants, indicating VOC content.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - 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 components.
 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes:
1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
 2. Roof insulation.
 3. Walkway pads or rolls.
 4. Termination bars.
 5. One insulation fastener of each type, length, and finish.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with the following:
1. Requirements specified in "Performance Requirements" Article in Part 2 of this Section.
 2. Requirements to provide specified warranties.
 3. Tested and listed by FM for class specified in "Performance Requirements" Article in Part 2 of this Section.
 4. Submit evidence of complying with performance requirements.
- B. Installer Certificates: Written certification of the Installer's experience and authorization from roofing system manufacturer for Installer to install roofing system.
- C. Sample Warranties: Sample of manufacturer's special warranties.
- D. Reports
1. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.
 2. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For membrane roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. General: Perform Work in strict compliance with the manufacturer's latest standards and details. When project is complete, notify Owner 48 hours prior to manufacturer's final inspection. All repairs necessary for the warranty will be made immediately thereafter.
- 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 warranty and has been specializing in performing the work of this Section, with a minimum of seven (7) years documented experience installing the specified roof system. In addition, the Contractor shall have at least seven (7) installations similar to the one specified with base manufacturer and must have had key personnel attend a quality control seminar hosted by the manufacturer in the past 12 months.
- C. Manufacturer's Qualifications: A qualified manufacturer who manufacture's the specified products, and has a UL listing for membrane roofing system identical to that used for this project.
- D. Source Limitations: Obtain components for membrane roofing system from a single source (Roofing system manufacturer). This includes, but is not limited to, tapered and flat insulation, underlayments, substrate/cover boards, membrane and accessories, metal copings and adhesives.

- E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A, ASTM E 108, for application and roof indicated.
- F. Preinstallation Conference: Conduct conference at Project site; comply with requirements in Division 01 Section "Project Meetings." Review methods and procedures related to roofing system including, but not limited to, the following:
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system and installation manufacturer's representative, and all installers whose work interfaces with and/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. Review 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 will affect 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.

1.8 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 any components of roofing system that fail (materials and workmanship) within specified warranty period.
 - 1. Special warranty includes ~~roofing~~, single ply membrane (EPDM), flashings, roof insulation, fasteners, substrate and cover boards, copings, and other components and accessories ~~needed~~ **required** for a complete and proper roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion which also includes Wind speed coverage of that indicated on structural drawings (**90 mph minimum**), hail coverage for up to 2 inch diameter, and accidental puncture coverage of 16 man hours per year of warranty.
 - a. Provide alternate price to increase warranty to 30 years.
 - 1) Submit manufacturer's enhancements required for 30 year warranty as opposed to 20 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Versico Incorporated; Versiguard 60 mil (walls/copings) and 90 mil (field) un-reinforced fully adhered roofing system.
 - 1. Carlisle SynTec Incorporated; Sure-Tough.
 - 2. Johns Manville; JM EPDM.
- B. 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: Provide installed membrane roofing and base flashings capable withstanding specified uplift pressures, thermally induced movement, **slope**, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction and incorporating membrane roofing and base flashings that 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: Provide roofing materials compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7 for following areas on roof:
 - 1. Corner Uplift Pressure: 135 lbf/sq. ft..
 - 2. Perimeter Uplift Pressure: 90 lbf/sq. ft..
 - 3. Field-of-Roof Uplift Pressure: 60 lbf/sq. ft..

- D. FM Global Listing: Provide membrane roofing, base flashings, and component materials complying with requirements in FM Global 4450 and FM Global 4470 as part of membrane roofing system, and are 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: SH.
- E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 EPDM MEMBRANE ROOFING

- A. Non-Reinforced EPDM Sheet: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.
 - 1. Thickness: 60 mils for vertical, parapet, applications and 90 mils for horizontal, field applications, nominal.
 - 2. Exposed Face Color: Black.

2.4 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Non-Membrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
 - l. Other Adhesives and Sealants: 250 g/L.
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- 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, approximately 1 by 1/8 inch thick; with stainless steel anchors.

- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 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, 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 SUBSTRATE BOARD (THERMAL BARRIER) / COVER BOARD

- A. General: Substrate and cover board shall be as specified below and by one manufacturer.
- B. Substrate Board (Thermal Barrier) / Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Building Products; Dens Deck **Prime**.
 - b. Certaineed Corp.; GlasRoc Sheathing Type X.
 - c. United States Gypsum Company; Securock Glass Mat Roof Board.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate panel to roof deck.

2.6 VAPOR RETARDER

- A. General: Vapor retarder is to be used on the concrete deck only.
- B. Self-Adhering Sheet Vapor Retarder: 40-mil-thick, fully adhered, polyethylene film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm; cold-applied, with slip-resisting surface and release-paper backing. Must be compatible ~~and approved by roofing manufacturer and under the same warranty as single ply membrane roof. With all other roofing components and warrantable as part of the roofing system.~~
 - 1. Available Products: As approved by roofing system manufacturer.

2.7 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer **to be utilized** as a part of the roofing system, 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 I, Grade 2, glass-fiber mat facer on both major surfaces.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Hunter Panels.
 - c. Johns Manville; a Berkshire Hathaway company.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches and 1/2 inch per 12 inches for crickets, 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.

2.8 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane 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 as follows:
 - 1. Full-spread spray-applied, low-rise, two-component urethane adhesive.

2.9 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that 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 Division 05 Section "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- 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.
- C. 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.

3.3 SUBSTRATE BOARD (THERMAL BARRIER)

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
 - 1. Fasten substrate board to top flanges of steel deck according to recommendations in FM Global's "RoofNav" and FM Global Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification.
 - 2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.4 VAPOR-RETARDER INSTALLATION

- A. Self-Adhering Sheet Vapor Retarder: Install on concrete deck only. Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder in a single layer over area to receive vapor retarder in accordance with vapor-retarder manufacturer's recommendations for the substrate indicated, side and end lapping each sheet as recommended by vapor-retarder manufacturer. Seal laps by rolling.
 - 1. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.5 INSULATION INSTALLATION

- A. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
 - 1. Coordinate installation of membrane roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
 - 2. Install tapered insulation under area of roofing to conform to slopes indicated.
 - 3. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer minimum of 6 inches in each direction.
 - 4. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
 - 5. Install insulation with long joints of insulation in continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 6. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- B. Mechanically Fastened Insulation and Substrate Board: Install ~~first layer of~~ insulation **and substrate board** to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation and substrate board according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation and substrate board to resist uplift pressure at corners, perimeter, and field of roof.
- C. **Fully** Adhered Cover Boards: Fully adhere cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.
 - 1. **Fully** adhere cover boards according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
 - 2. Adhere cover boards to resist uplift pressure at corners, perimeter, and field of roof.

- D. Install sumps at all roof drains as shown on the drawings.

3.6 FULLY ADHERED MEMBRANE ROOFING INSTALLATION

- A. **Fully** adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow membrane to relax before installing.
 - 1. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
 - 2. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
 - 3. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.
 - 4. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
 - 5. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.
- B. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- C. Factory Applied Seam Tape Installation: Clean and prime both faces of splice areas, apply factory applied 6 inch seam tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.
- D. Roof Drains: Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane 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.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated and adhere to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: ~~Owner will engage Contractor to~~ engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

~~1. Electric Field Vector Mapping (EFVM): Testing agency shall survey entire roof area for potential leaks using electric field vector mapping (EFVM).~~

B. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

- 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.**
- 2. Flood each area for 24 hours.**
- 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.**

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
2. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075323

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes sheet metal items as shown on the drawings.
- B. Through wall metal flashing.
- C. Formed through wall flashings with end dams where shown or required.
- D. Formed metal counter flashings.

1.2 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 - 2. Review methods and procedures related to sheet metal flashing and trim.
 - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 4. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that will affect sheet metal flashing.
 - 5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
 - 6. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 7. Review requirements for insurance and certificates if applicable.
 - 8. Review sheet metal flashing observation and repair procedures after flashing installation.

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 for each manufactured product and accessory.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between factory- shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 4. Details of termination points and assemblies, including fixed points.
 5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 7. Details of special conditions.
 8. Details of connections to adjoining work.
 9. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
1. Sheet Metal Flashing: 12 inches 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 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, trim, and accessories to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Fabricator Qualifications: Shop that 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.
 1. For copings and roof edge flashings that are SPRI ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved. Coordinate with Division 07 Section "Roof Specialties."
 - B. Mockups: **Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance." Test mockups in accordance with Division 08 Section "Structural Sealant Glazed Curtainwall." ~~Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.~~**
 - ~~1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.~~
 - ~~2. 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 the extent necessary for the period of sheet metal flashing and trim installation.

1.9 WARRANTY

- A. Special Warranty on Coil-Coated Metal with Fluoropolymer Finishes: Manufacturer's standard form in which 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 as indicated 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 Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes to prevent 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.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. LEED Requirements
 - a. Credit MR 4: Provide aluminum sheet with not less than 90 percent recycled content (post-consumer plus 1/2 pre-consumer).
 - b. Credit MR 5.1: Provide aluminum sheet consisting of material extracted, processed and manufactured not more than 500 miles from the project location.
 - 2. Surface: Smooth, flat.
 - 3. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.
 - 4. Exposed Coil-Coated Finishes:

- a. Three-Coat Fluoropolymer: AAMA 620. 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.
 - b. Color: Two custom colors as selected by Architect.
- 5. 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.
- C. Stainless-Steel Sheet: 26 ga. ASTM A 666, Type 304, dead soft, fully annealed.
 - 1. Finish: 2B.
 - 2. Surface: Smooth, flat.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Aluminum or passivated Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, Grade Sn50 Lead/tin, **minimum**, with an acid flux of type recommended by stainless-steel sheet manufacturer.
- D. 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.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Provide stainless steel premanufactured end dams and soldered corners where required. **20 or 26 ga, type 304.**

2.4 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 indicated. Fabricate items at the 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 without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
 5. Fabricate corners, intersections and transitions in shop.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a 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.
1. For embedment of metal flashing flanges in roofing or composition flashing or stripping, extend flanges for a minimum of 4-inches embedment.
- C. Sealant Joints: Where movable, non-expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
1. Provide for thermal expansion of running items of more than 15 feet continuous length.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured and from same material as accessory being anchored or from compatible, non-corrosive metal.
- F. Seams: Fabricate nonmoving seams with flat-lock seams.
1. Metals Being Soldered: Tin edges to be seamed, form seams, and solder.
 2. Aluminum Sheet and Metals with Coated Finish: Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 3. Aluminum Sheet without Painted or Coated Finish: Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- G. Do not use graphite pencils to mark metal surfaces.

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.
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. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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, welding rods, 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 and levels indicated. 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 apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
 - 7. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals will contact each other, or where metal contacts pressure-treated wood or corrosive substrates, protect against galvanic action 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 back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. 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 watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints. Use lapped expansion joints only where indicated on Drawings.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- 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 shown and as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, 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.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except 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. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended 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.
 4. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.
- H. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.3 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, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standards 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 beyond wall openings.

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim 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.

3.6 CLEANING AND PROTECTION

- A. Clean and neutralize flux materials. Clean off excess solder.
- B. Clean off excess sealants.
- C. 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 installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.
- D. 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

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SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof-edge specialties.
- B. 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.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes to indicate compliance with specified requirements.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: For roof specialties.
 - 1. Provide sufficient detail to illustrate size, shape, fabrication, installation and anchorage.
 - 2. Shop drawings must have been reviewed by Architect prior to Contractor initiating work.
 - 3. Include plans, elevations, keyed details, and attachments to other work. Distinguish between factory-assembled or field-assembled work.
 - 4. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 5. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 6. Detail termination points and assemblies, including fixed points.
 - 7. Include details of special conditions.
- D. Samples: For each type of roof specialty and for each color and texture specified.

1.3 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.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products that are certified to meet SRR1 ES-1 performance test criteria and meeting requirements that are 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 each type of roof edge shown on Drawings.
 - 2. Build mockup of typical roof edge as part of Integrated Exterior Mockup specified in Section 014000 "Quality Requirements"
 - 3. Build mockup of typical roof edge, including fascia, approximately 10 feet long, including supporting construction, seams, attachments, splice plate, and accessories.
 - 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. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 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.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements and layout 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.

1.8 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.

- B. Special Performance/20 Year Warranty: Manufacturer shall guarantee that the coping system, when installed per manufacturer's instructions, will not blow off or cause membrane failure, even in wind conditions up to 110 mph, or the manufacturer shall replace or repair their material.
- C. "Total System Warranty": Coping must comply with and be warrantable under roofing manufacturer's "Total System Warranty."

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. 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.
- C. 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, ambient; 180 deg F, material surfaces.

2.2 ROOF-EDGE SPECIALTIES

- A. Prefinished, Premanufactured Coping: Metal coping cap with galvanized steel anchor/support cleats for capping any parapet wall. The system shall be maintenance free and shall not require exposed fasteners. Joints shall be butt type with concealed splice plates.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Metal-Era, Inc.; provide two custom colors selected by the Architect or comparable product by one of the following:
 - a. Hickman Company, W.P.

2.3 MATERIALS

- A. Aluminum Sheet: ASTM B 209 , alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- B. Aluminum Extrusions: ASTM B 221 , alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

2.4 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. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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. Three-Coat Metallic Fluoropolymer: AAMA 2605. Fluoropolymer finish with suspended metallic flakes 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, 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 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. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. 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 with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F, 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 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.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 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.

3.4 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 and sealants.
- C. 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.
- D. 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

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SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof hatches.
 - 2. Other roof mounted items.

1.2 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

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1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco Company; Type L roof hatch or comparable product by one of the following:
 - a. Nystrom, Inc.
 - b. O'Keeffe's Inc.
- B. Type and Size: Single-leaf lid, 30 by 96 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Aluminum sheet.
 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 2. Finish: Mill.
- E. Construction:
 1. Insulation: Polyisocyanurate board.
 - a. R-Value: 12.0 according to ASTM C 1363.
 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
- F. Hardware: Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
 1. Provide two-point latch on lids larger than 84 inches.
- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; provide ability to attach to roof hatch and remove after use and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
 1. Height: 42 inches above finished roof deck.
 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
 3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
 4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
 5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
 6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
 8. Fabricate joints exposed to weather to be watertight.
 9. Fasteners: Manufacturer's standard, finished to match railing system.
 10. Finish: Manufacturer's standard.
 - a. Color: As selected by Architect from manufacturer's full range.

2.2 METAL MATERIALS

- A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 1. Mill Finish: As manufactured.

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.

- B. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- C. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.3 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. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- C. 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 AWWA C2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. 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.
- F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.4 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 accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 2. Anchor roof accessories 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 accessories and fit them to substrates.

4. Install roof accessories 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. Coat concealed side of stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
 - C. Roof-Hatch Installation:
 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 2. Attach safety railing system to roof-hatch curb.
- 3.3 REPAIR AND CLEANING
- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.
 - B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
 - C. Clean exposed surfaces according to manufacturer's written instructions.
 - D. Clean off excess sealants.
 - E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes sprayed fire-resistive materials (SFRM).

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to SFRM including, but not limited to, the following:
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.
 - 2. Review and finalize construction schedule and verify sequencing and coordination requirements.
 - 3. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
 - 4. Review surface conditions and preparations.
 - 5. Review field quality-control testing procedures.
 - 6. Review of fire protected areas vs. non-fire protected areas.

1.3 SEQUENCING

- A. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
- B. Metal Decks: Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
 - 1. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
- C. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
- D. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
- E. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
- C. Shop Drawings: Framing plans, schedules, or both, indicating the following:
 - 1. Locations and types of surface preparations required before applying fireproofing.
 - 2. Extent of fireproofing for each construction and fire-resistance rating.

3. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
4. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
5. Designation of restrained and unrestrained conditions based on definitions in ASTM E 119, Appendix X3 as determined by a qualified engineer.
6. Treatment of fireproofing after application.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fireproofing, signed by product manufacturer.
- B. Compatibility and Adhesion Test Reports: From fireproofing manufacturer indicating the following:
 1. Materials have been tested for bond with substrates.
 2. Materials have been verified by fireproofing manufacturer to be compatible with substrate primers and coatings.
 3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Field quality-control reports and special inspection reports.
- E. Manufacturer Letter: Verifying that the UL Designs selected for the project are not load restricted.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its fireproofing to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
 1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility for designation of restrained and unrestrained conditions.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on fireproofing.
- B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
 1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
- B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
- C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated on Drawings by design designations in UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Steel members are to be considered unrestrained unless specifically noted otherwise.
 - 3. UL Design listings must state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL Design listings requiring a load restriction factor are not allowed.
- D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Primers, Sealers, and Undercoaters: 200 g/L.
 - 4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
- E. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. SFRM : Manufacturer's standard, cementitious (no fiber allowed) factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 5MD.
 - b. Grace, W. R. & Co. - Conn.; Grace Construction Products; (BASIS-OF-DESIGN) Monokote Z106G..
 - c. Isolatek International; Cafco 400.
2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
 3. Bond Strength: Minimum 200-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.
 4. Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
 5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
 6. Combustion Characteristics: ASTM E 136.
 7. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Developed Index: 10 or less.
 8. Compressive Strength: Minimum 8.33 lbf/sq. in. according to ASTM E 761.
 9. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 10. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 11. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
 12. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
 13. Finish: Spray-textured finish.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
 - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
 - 2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.
- C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.
- D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
 - 1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
 - 2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
 - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks:
 - 1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
 - 2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.
- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- J. Cure fireproofing according to fireproofing manufacturer's written recommendations.
- K. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- L. Finishes: Where indicated, apply fireproofing to produce the following finishes:
 - 1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, 1704.10.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

- D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100

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SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.
4. Control voltage, communications and electronic safety and security cable penetrations.

1.2 PREINSTALLATION MEETINGS

- A. Pre-Installation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For penetration firestopping sealants and sealant primers, documentation including printed statement of VOC content.

- C. Product Schedule: For each penetration firestopping system. Include location and design designation of Underwriter's Laboratories (UL).

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," and been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1. Where applicable, licensed by the State where the Project is located or local Authority Having Jurisdiction (AHJ).

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hilti, Inc.
 - 2. Specified Technologies Inc.
 - 3. 3M Fire Protection Products.

2.2 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. Provide penetration firestopping systems bearing classification marking of UL in its "Fire Resistance Directory."

2.3 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Where openings around penetrating items do not meet UL system requirements, provide materials and systems with matching construction materials as required by the annular opening size requirement of the UL system. Where the opening cannot be closed as required to meet the annular opening size requirements of UL, obtain an engineering judgment of the UL system to be used from the Engineering Department of the manufacturer of the firestopping materials, verified in writing by UL.

- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls, and fire partitions.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
 - 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. Control Voltage, Communications and Electronic Safety and Security Cable Penetrations in Fire-Resistance-Rated Walls and Smoke Barriers: Provide penetration firestopping with ratings described in this Section and with the ability for Owner to add or remove cables without the need for replacing fill materials.
 - 1. Products: Subject to compliance with the requirements, provide one of following fire-rated assemblies:
 - a. CP 653 Speed Sleeve by Hilti, Inc.
 - b. EZ Path Series 44+ by Specified Technologies, Inc.
 - 2. Provide collars and plates required for mounting single and multiple devices adjacent to each other.
 - 3. Accessories: Provide following accessories required for applications indicated on Drawings:
 - a. Extension module increasing effective length.
 - b. Radius control module providing minimum bend radius for twisted pair cables.
 - c. Multi-gang wall bracket to allow one to five pathways in finished wall to be supported from stud.
 - d. Modular floor grid system allowing banks of pathways in floor.
 - e. T-rating accessory kit.
 - f. Caps for unoccupied wall bracket gangs to allow future capacity.
- F. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- G. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- H. 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 manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:

- a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
- 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

2.4 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended 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 Collars: 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 elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Pillows/Bags: Reusable heat-expanding pillows, bags or cushions 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.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.
- J. Putty Pad or Box Insert: Protective materials designed to protect electrical outlet boxes.
- K. Firestop Board: Material for large openings to accommodate electrical busways, raceways, cable trays, and multiple copper pipes.
- L. Drop-In Device: Pre-formed device with integrated intumescent strips for use with noncombustible and combustible pipes and/or cable bundles.
- M. Firestop Plug: Intumescent system for sealing the ends of empty or abandoned sleeves with zero percent cable load.

2.5 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping 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: Clean out openings immediately before installing penetration firestopping 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.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: 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.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.
- D. Control Voltage, Communications and Electronic Safety and Security Cable Penetrations in Fire-Resistance-Rated Walls and Smoke Barriers: Coordinate calculations of allowable fill ratio with control voltage, communications and electronic safety, and security installers to ensure size of sleeves, openings, core-drilled holes, or cut openings can accommodate cable load according to specified conduit fill.

3.3 INSTALLATION

- A. General: Install penetration firestopping 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 fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 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.
- D. Control Voltage, Communications and Electronic Safety and Security Cable Penetrations in Fire-Resistance-Rated Walls and Smoke Barriers:
1. Where specified mechanical device cannot be used in openings in floors and walls, provide products that allow re-entry and do not cure or dry.
 2. Where empty sleeves are installed for future cables or as abandoned cables are harvested, seal both sides of empty sleeves with firestop plug.

3.4 IDENTIFICATION

- A. Identify Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations by permanent identification with signs or stenciling. Provide at the following locations:
1. Accessible concealed floor, floor-ceiling or attic spaces.
 2. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition.
 3. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in a contrasting color incorporating the following wording:
 - a. "FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS" or other wording approved by the Authority Having Jurisdiction.
- B. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. 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.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping 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 manufacturers and that do not damage materials in which openings occur.

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- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is 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 and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION UL CLASSIFICATION SYSTEM

		Construction Penetrated	Type of Construction	System Identification
A.	No penetrating Items:	F,W,C	A,B,J,K,L	0001-0999
B.	Metallic Pipes, Conduit or Tubing:	F,W,C	A,B,J,K,L	1001-1999
C.	Nonmetallic Pipe, Conduit or Tubing:	F,W,C	A,B,J,K,L	2001-2999
D.	Electric Cables:	F,W,C	A,B,J,K,L	3001-3999
E.	Cable, Trays with Electric Cables:	F,W,C	A,B,J,K,L	4001-4999
F.	Insulated Pipes:	F,W,C	A,B,J,K,L	5001-5999
G.	Electrical Bussduct Penetrations:	F,W,C	A,B,J,K,L	6001-6999
H.	Mechanical Ductwork Penetrations:	F,W,C	A,B,J,K,L	7001-7999
I.	Multiple Penetrations Through Common Openings:	F,W,C	A,B,J,K,L	8000-8999

Key to Construction Penetrated

- F Floor Penetration
W Wall Penetration
C Either floor or wall penetration

Key to Type of Construction

- A- Concrete floors equal to or less than 5-inches thick
B- Concrete floors greater than 5-inches thick
J- Concrete or masonry walls equal to or less than 8-inches thick
K- Concrete or masonry walls greater than 8-inches thick
L- Framed Walls

END OF SECTION 078413

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SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

1.2 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For fire-resistive joint system sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For fire-resistive joint system sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."

C. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.5 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
 - 1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join or 1 hour, whichever is greater.
 - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. Specified Technologies Inc.
 - c. 3M Fire Protection Products.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. Specified Technologies Inc.
 - c. 3M Fire Protection Products.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
 - 1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hilti, Inc.
 - b. Specified Technologies Inc.
 - c. 3M Fire Protection Products.
- E. Joints between floor and roof edges and precast or panel systems:
 1. Safing Insulation- Where required, fill void at floor and roof edges with one of the following:
 - 1) Thermafiber Safing Insulation,
 - 2) Roxul Safe or
 - 3) Other approved by Architect.
 - b. Thickness shall be four inches minimum top to bottom.
 - c. Cut safing insulation wider than opening to provide compression fit recommended by manufacturer.
 2. Smoke Seal- Where safing insulation is installed, completely coat top surface of safing insulation with one of the following:
 - 1) 3M FireDam Spray 200,
 - 2) SpecSeal AS200 Elastomeric Spray,
 - 3) Johns Manville Firetemp SE,
 - 4) Hilti CP672 Firestop Joint Spray or approved equal.
 - b. Coating shall overlap floor and wall a minimum of 0.5 inch (13 mm). Provide minimum wet thickness 0.125 inch (3 mm).
 - c. Comply with manufacturer requirements for temperature and condition of substrates at time of installation.
 3. Support safing insulation on galvanized steel impaling clips that bear on top of floor structure, spaced at maximum 12 inches (305 mm) on center.
 4. Where safing and smoke seal are interrupted at a stairwell, shear wall, or any other condition that prevents continuity, provide vertical safing and smoke seal to close gaps between horizontal lines of safing at successive floors. Where needed to maintain continuity, provide safing and smoke seal between exterior wall and beams, columns and other structure surfaces where floor slabs are interrupted or do not occur.
- F. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- H. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems 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: Clean joints immediately before installing fire-resistive joint systems 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 fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint 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.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

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 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 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 fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 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. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint 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 - Fire-Resistive Joint System - 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.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint 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 fire-resistive joint 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 078446

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SECTION 079100 - PREFORMED JOINT SEALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preformed, foam joint seals.

1.2 ACTION SUBMITTALS

- A. Product Data: For each preformed joint seal product.
- B. Samples for Verification: For each type and color of preformed joint seal required, provide Samples with joint seals in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint seals.
- C. Preformed Joint Seal Schedule: Include the following information:
 - 1. Joint seal location and designation.
 - 2. Joint width and movement capability.
 - 3. Joint seal manufacturer and product name.
 - 4. Joint seal color.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each preformed joint seal for tests performed by a qualified testing agency.

1.4 QUALITY ASSURANCE

- A. Mockups: Install mockups of assemblies specified in other Sections that are indicated to receive preformed joint seals specified in this Section. Use materials and installation methods specified in this Section.

1.5 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace preformed joint seals that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PREFORMED, FOAM JOINT SEALS

- A. Preformed, Foam Joint Seals : Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Products: Subject to compliance with requirements, provide the following:
 - a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
 2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.
 3. Joint Seal Color: As selected by Architect from full range of industry colors.
- B. Interior Preformed Seals: Provide manufacturer's standard open-cell foam infused with a mass-loading, fire-retardant impregnations with custom silicone color on 2 or 3 sides as need to conceal foam.
1. Products: Subject to compliance with requirements, provide the following:
 - a. EMSEAL Joint Systems, Ltd.; QuietJoint SSH or SHG.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.
- 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 preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal 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 optimal bond with preformed joint seals. 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 seals. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.

- B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

- A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. 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.

3.4 PROTECTION

- A. Protect preformed joint seals from damage resulting from construction operations or other causes so seals 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 seals immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079100

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Latex joint sealants.
3. Acoustical joint sealants.

1.2 PRECONSTRUCTION TESTING

A. 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 ASTM C 1087 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 kind 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, not older than 24 months, of sealant products for adhesion to, 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 application indicated below:
 - a. Each kind of sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. 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.
 - 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.
5. 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.
6. 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants 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.
- E. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Preconstruction 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. 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.
- G. Field-Adhesion Test Reports: For each sealant application tested.
- H. 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. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

- D. 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 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 or are below 40 deg F.
 - 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.

1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which 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: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Twenty years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Non-Sag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Tremco Incorporated; Spectrem 1.
- B. Single-Component, Non-Sag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. Tremco Incorporated; Spectrem 800.
- C. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Building Systems; Omniplus.
 - b. Dow Corning Corporation; 786 Mildew Resistant.
 - c. GE Advanced Materials - Silicones; Sanitary SCS1700.
 - d. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: 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 Building Systems; Sonolac.
 - b. Pecora Corporation; AC-20+.
 - c. Tremco Incorporated; Tremflex 834.

2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following (equivalent products may be approved with consent of Acoustical Consultant):
 - a. Non-Rated:
 - 1) USG Corporation; Acoustical Sealant.
 - b. Fire-Rated:
 - 1) Spec Seal ES.

2.5 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 1. Use Type O on interior joint of double sealant joints only.
- 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.

2.6 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.
- D. Weep Tube: Tube to fill width of joint indicated for use. Color is to match the surrounding sealant color.

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 joint-sealant performance.
- 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. Where double line of sealants are called for, utilize open cell backer rod on interior joint to allow sealant to dry to the inside of the building. Provide a tube for water drainage/weepers where there is a change in downward movement of fluids, including but not limited to shelf angles, floor lines and lintels.
 - 1. Install interior joint and allow to dry/cure prior to installing second joint.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. 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.
- G. Tooling of Non-Sag 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.

H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 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 of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 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 passes 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 fill, 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.

3.5 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.

3.6 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. 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 listed above.
 - c. Other joints as indicated.
 - 2. Silicone Joint Sealant: Single component, non-sag, traffic grade, neutral curing.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal non-traffic surfaces.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Control and expansion joints in unit masonry.
 - c. Joints between composite metal panels.
 - d. Joints between dissimilar materials.
 - e. Perimeter joints between materials listed above and aluminum glazed curtain wall, frames of doors, windows and louvers.
 - f. Control and expansion joints in ceilings and other overhead surfaces.
 - g. Hollow metal doors and frames.
 - h. Other joints as indicated.
 - 2. Silicone Joint Sealant: Single component, non-sag, neutral curing, Class 100/50.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
 - 2. Silicone Joint Sealant: Single component, non-sag, traffic grade, neutral curing.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of walls and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
 - f. Other joints as indicated.
 - 2. Joint Sealant: Latex.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant Location:

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- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Single component, non-sag, mildew resistant, acid curing, silicone.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal non traffic surfaces.
- 1. Joint Location:
 - a. Acoustical joints where indicated.
 - b. Other joints as indicated.
 - 2. Joint Sealant: Acoustical.

END OF SECTION 079200

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SECTION 079500 - EXPANSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior wall expansion control systems.

1.2 ACTION SUBMITTALS

- A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- B. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches long in size.
- C. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Manufacturer and model number for each expansion control system.
 - 2. Expansion control system location cross-referenced to Drawings.
 - 3. Nominal joint width.
 - 4. Movement capability.
 - 5. Classification as thermal or seismic.
 - 6. Materials, colors, and finishes.
 - 7. Product options.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
 - 2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.
- B. Coordination: Coordinate installation of exterior wall expansion control systems with roof expansion control systems to ensure that wall transitions are watertight.

2.2 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in schedule at the end of this section or a comparable product by one of the following:
 - 1. Balco, Inc.
 - 2. Construction Specialties, Inc.
 - 3. JointMaster/InPro Corporation.
 - 4. Michael Rizza Company, LLC.

5. MM Systems Corporation.

- B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

2.3 MATERIALS

- A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

- B. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.4 GENERAL FINISH REQUIREMENTS

- 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.

2.5 ALUMINUM FINISHES

- A. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion control system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
 - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
 - 5. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 - 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
 - 1. Provide in continuous lengths for straight sections.
 - 2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 - 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

3.4 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

3.5 EXPANSION JOINT SCHEDULE

- A. E-1 Interior Floor: MM Systems heavy duty floor cover system, Model # SSP-C-600 for both slab to slab and slab to wall applications. Color as selected by Architect from manufacturer's full range. (provide fire rated if required by floor construction)
- B. E-2 Interior Wall and Ceiling: Michael Rizza Company premium silicone systems, Model # IS-4. Color as selected by Architect from manufacturer's full range. (provide fire rating if required by wall or ceiling construction)
- C. E-3/~~F-1~~ Exterior Wall: Michael Rizza Company premium silicone systems, Model # ~~EV-4~~ # **EV-6** or MM Systems VSS-6, for exterior wall and soffit conditions. Custom color as selected by Architect. (provide fire rating if required by wall construction)
- D. E-4/~~F-2~~ Roof to Wall: ~~Michael Rizza Company premium silicone systems, Model # RW-4g.~~ **MM Systems WJL-6-6** Custom color as selected by Architect from manufacturer's full range. (provide fire rating if required by roof or wall construction)

- E. E-5 Roof to Roof: Michael Rizza Company premium silicone systems, Model RR-4g. Color as selected by Architect from manufacturer's full range. (provide fire rating if required by roof construction)

END OF SECTION 079500

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal doors and frames, transom panels and louvers.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8, most current edition.

1.3 COORDINATION

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

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Credit MR 5.1 (Regional Materials) and MR 5.2 (Regionally Extracted Materials): Submit a statement from the steel or other metal manufacturer stating the distance between the place of extraction, processing, and manufacture and the project location.
- C. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
 - 10. Indicate glazing materials, including fire-rated glazing.
 - 11. Interface with water proofing and fluid applied membrane air barrier.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
 - 2. Inspect on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Curries Company; an Assa Abloy Group company.
 - 3. Mesker Door Inc.
 - 4. Republic Doors and Frames.
 - 5. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer regularly engaged in the manufacture of hollow metal doors and frames for not less than 5 years.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly 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.
 - 2. Temperature-Rise Rating: Where indicated and where steel doors are shown in stairwells and exit enclosures, provide doors that have a temperature-rise rating of 450 degrees F maximum in 30 minutes of fire exposure.
- B. Fire-Rated, Borrowed-Light Assemblies and Fire-Rated Window Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

- B. Standard-Duty Doors and Frames: SDI A250.8, Level 1.
 - 1. Physical Performance: Level C according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.032 inch.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 3. Frames:
 - a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
 - 1. Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 2. Thermal-Break Frames: Provide thermal-break frame that separates interior and exterior sections of frame by frame manufacturer's standard continuous thermal break.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Polyurethane.
 - 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - b. Construction: Full profile welded.
 - 4. Exposed Finish: Prime.

2.5 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.7 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Regional Materials: To the greatest extent possible, provide sheet steel manufactured within 500 miles of the Project.
- C. Regionally Extracted Materials: To the greatest extent possible, provide materials that have their source as a raw material from within a 500-mile radius of the project site.
- D. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- E. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- F. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- G. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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.
- H. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- I. 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.
- J. Glazing: Comply with requirements in Division 08 Section "Glazing."

2.8 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 - 4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. Sidelight 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 butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 5. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
 6. 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.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; 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 applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 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.
 4. Provide loose stops and moldings on inside of hollow-metal work.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

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.

2.10 ACCESSORIES

- A. Louvers: Provide louvers, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
 - C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: [3/4 inch] [5/8 inch] plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
 - D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
 - B. Remove grout and other bonding material from hollow-metal work immediately after installation.
 - C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
 - D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

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SECTION 081216 - ALUMINUM FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes interior aluminum frames for doors and glazing installed in gypsum board partitions.

1.2 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: Include the following:
 - 1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 2. Locations of reinforcements and preparations for hardware.
 - 3. Details of each different wall-opening condition.
 - 4. Details of anchorages, joints, field splices, and connections.
 - 5. Details of accessories.
 - 6. Details of moldings, removable stops, and glazing.
 - 7. Details of conduits and preparations for power, signal, and control systems.
- C. Samples for Verification: For interior aluminum frames, prepared on Samples of size indicated below:
 - 1. Framing Member: 12 inches long.
 - 2. Corner Fabrication: 12-by-12-inch- long, full-size window corner, including full-size sections of extrusions with factory-applied color finish.
- D. Schedule: For interior aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of interior aluminum frame.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For interior aluminum frames to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain interior aluminum frames from single source from single manufacturer.
- B. Fire-Rated Assemblies: Assemblies 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.
- C. Smoke- and Draft-Control Assemblies: At corridors, smoke barriers, and smoke partitions, provide assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

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1. Build mockup of typical wall area as shown on Drawings.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver interior aluminum frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic. Store interior aluminum frames under cover at Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. RACO Interior Products, Inc.
 2. Wilson Partitions.
 3. Kawneer (storefronts).
 4. Tubelite INT45

2.2 COMPONENTS

- A. Aluminum Framing: ASTM B 221, Alloy 6063-T5 or alloy and temper required to suit structural and finish requirements, not less than 0.062 inch thick.
- B. Door Frames: Extruded aluminum, wide stile, reinforced for hinges, strikes, and closers.
1. 90-Minute Fire-Protection Rating: Where indicated, fabricate aluminum frame assemblies with a cold-formed, primed, interior steel liner.
- C. Glazing Frames: Extruded aluminum, for glazing thickness indicated.
1. Type 1: To accommodate 1/4 inch tempered glass.
 2. Type 2: To accommodate 5/8 inch tempered glass.
- D. Ceiling Tracks: Extruded aluminum.
- E. Trim: Extruded aluminum, not less than 0.062 inch thick, with removable snap-in glazing stops and door stops without exposed fasteners.

2.3 ACCESSORIES

- A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals; color to match aluminum finish.
- C. Smoke Seals: Intumescent strip or fire-rated gaskets; color to match finish.
- D. Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated; color to match finish.
- E. Glazing: Comply with requirements in Section 088000 "Glazing."
- F. Hardware: Comply with requirements in Section 087100 "Door Hardware" and Section 087111 "Door Hardware (Descriptive Specification)."

- G. Trim: Brake formed aluminum with back cut corners to produce sharp edge with finish to match color of curtain wall or storefront as indicated.

2.4 FABRICATION

- A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.
- B. Factory prepare interior aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Section 087100 "Door Hardware."
 - 1. Locate hardware as required by fire-rated label for assembly.
- C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
 - 1. Locate removable stops on the inside of spaces accessed by keyed doors.
- D. Fabricate components to allow secure installation without exposed fasteners.

2.5 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.

2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat metallic fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Custom color as selected by the Architect.
 - 2. All interior aluminum and glass doors to match adjacent Interior Glazing System color and gloss.

2.7 INTERIOR GLAZING SYSTEMS

- A. IGS-1:
 - 1. Location: Office fronts (area B).
 - 2. Framing: Aluminum framing at perimeter and door frames only. Basis-of-Design Wilson Partitions Snap On Trim System – 1-1/2 inch.
 - 3. Glazing: GLI-1C with silicone sealed butt joints at intermediate joints.
 - 4. Doors: Wood doors as scheduled.
- B. IGS-2:
 - 1. Location: Lab fronts (area A).
 - 2. Framing: Aluminum storefront framing. 1-3/4 inch by 4-1/2 inch center glazed system.
 - 3. Glazing: GLI-1A or 1B as noted. 3/8 inch.
 - 4. Doors: Aluminum and glass doors, medium stile.
- C. IGS-3:
 - 1. Location: Conference room.

2. Framing: Aluminum storefront framing. 2 inch by 4-1/2 inch at perimeters and doors only.
3. Glazing: GLI-4 with silicone sealed butt joints at intermediate joints.

D. IGS-4:

1. Location: Level 02 Classrooms
2. Framing: Aluminum storefront framing. 2 inch by 4-1/2 inch at perimeters and doors only.
3. Glazing: GLI-8, with silicone sealed butt joints at intermediate joints.

E. IGS-5:

1. All glass system with channels top and bottom.
2. Glazing: GLI-9.

F. IGS-6:

1. Match adjacent EGS-2 structural sealant glazed curtain wall.
2. Glazing: GLI-4 with filler in glazing channel.

2.8 INTERIOR DOOR SCHEDULE

A. C250A:

1. Match exterior curtainwall door finish and type.
2. Sweeps recessed into door bottom.
3. Provide seals at door edges.
4. Pair of doors.

B. C230A:

1. Match finish and type of IGS-3: 2 inches by 4-1/2 inches, white.
2. Sweeps recessed into door bottom.
3. Provide seals at door edges.

C. C153:

1. Match finish and type of IGS-3: 2 inches by 4-1/2 inches, white.
2. Sweeps recessed into door bottom.
3. Provide seals at door edges.

D. 231 & 233:

1. Single doors with STC 30 rating
2. 5/8 inch laminated glass.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and ceilings, with Installer present, for conditions affecting performance of the Work.
- B. Verify that wall thickness does not exceed standard tolerances allowed by throat size indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install interior aluminum frames plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

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- B. Set frames accurately in position and plumbed, aligned, and securely anchored to substrates.
 - 1. At fire-protection-rated openings, install interior aluminum frames according to NFPA 80 and NFPA 105.
- C. Install frame components in the longest possible lengths; components up to 96 inches long must be one piece.
 - 1. Fasten to suspended ceiling grid on maximum 48-inch centers, using sheet metal screws or other fasteners approved by frame manufacturer.
 - 2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
 - 3. Secure clips to extruded main-frame components and not to snap-in or trim members.
 - 4. Do not leave screws or other fasteners exposed to view when installation is complete.

3.3 CLEANING

- A. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AAMA 609 & 610.
- B. Touch up marred frame surfaces so touchup is not visible from a distance of 48 inches. Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION 081216

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer and medium-density-overlay faces.
2. Shop priming and Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
3. Chain-of-Custody Qualification Data: For manufacturer and vendor.
4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
5. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Undercuts.
4. Indicate requirements for veneer matching.
5. Indicate doors to be factory finished and finish requirements.
6. Indicate fire-protection ratings for fire-rated doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.
- D. Store doors flat on level raised platforms in clean, dry, well ventilated area protected from sunlight and weather. Cover but allow for air circulation.

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 the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which 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 in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch 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. Algoma Hardwoods, Inc.
 - 2. Eggers Industries.
 - 3. Graham; an Assa Abloy Group company.
 - 4. Marshfield Door Systems, Inc.
 - 5. Oshkosh Architectural Door Company.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards"
 - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
- B. Regional Materials: Wood doors shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- C. Certified Wood: Wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- D. Adhesives: Do not use adhesives that contain urea formaldehyde.

- E. Composite Wood Products: Products shall be made without urea formaldehyde.
- F. 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. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
 - 3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - 5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- G. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- H. Particleboard-Core Doors:
 - 1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2 , made with binder containing no urea-formaldehyde resin.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
- I. 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.
 - 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: 475 lbf per WDMA T.M.-10.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors :
 - 1. Grade: Premium, with Grade A faces.
 - 2. Species: White oak.
 - 3. Cut: Quarter sliced, with grain running horizontally unless noted otherwise.
 - 4. Match between Veneer Leaves: Book match.
 - 5. Assembly of Veneer Leaves on Door Faces: Running match.
 - 6. Pair and Set Match: Provide for doors hung in same opening.
 - 7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
 - 8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
 - 9. Exposed Vertical and Top Edges: Same species as faces - edge Type A.

10. Stiles (and Tops): Provide 1-7/16 inch two-ply stiles (and tops) with minimum 1/4 inch solid lumber outer plies. Veneered edges will not be accepted. Wood to match veneer.
11. Core: Particleboard.
12. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 DOORS FOR OPAQUE FINISH

A. Interior Solid-Core Doors :

1. Grade: Custom.
2. Faces: Medium-density overlay.
 - a. Apply medium-density overlay to standard-thickness, closed-grain, hardwood face veneers or directly to high-density hardboard crossbands.
 - b. Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
 - c. MDF Faces: ANSI A208.2, Grade 150 or 160.
3. Exposed Vertical and Top Edges: Any closed-grain hardwood.
4. Core: Particleboard.
5. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

2.5 LOUVERS AND LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows 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.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.6 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 requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied, including drilling pilot holes for hinge screws and lock fronts. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Cut and trim openings through doors in factory.
 1. Light Openings: Trim openings with moldings of material and profile indicated.

2.7 SHOP PRIMING

- A. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section "Interior Painting". Seal all four edges, edges of cutouts, and mortises with primer.

2.8 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 top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
- C. All doors are to be finished as outlined below except Door 150 is to match the doors in the adjacent EAB.
- D. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
 - 3. Staining: As selected by Architect from manufacturer's full range.
 - 4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
 - 5. Sheen: Satin.
- E. Opaque Finish:
 - 1. Grade: Custom.
 - 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
 - 3. Color: As selected by Architect from manufacturer's full range.
 - 4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that 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 Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames 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.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

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- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

1.2 ALLOWANCES

- A. Access doors and frames are part of an access door and frame allowance.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames.

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 Concealed Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. Karp Associates, Inc.
 - d. Nystrom, Inc.
 - 2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
 - 5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
 - 6. Frame Material: Same material and thickness as door.
 - 7. Latch and Lock: Latch bolt, key operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Concealed Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. Karp Associates, Inc.
 - d. Nystrom, Inc.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory primed.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch, 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-closing, self-latching door hardware, operated by key.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 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.
 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Latch and Lock Hardware:
 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 2. Keys: Furnish two keys per lock and key all locks alike.

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 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.

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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 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

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SECTION 083333 - SIDE COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes side coiling fire and smoke rated doors with integral egress door.
 - 1. All exposed elements such as corridor doors, ceiling tracks and other items shall comply with the health network's infection control requirements and shall be provided by the manufacturer.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings.
- B. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include elevations, sections, and details indicating dimensions, materials, finishes, conditions for anchorage and support of each door.
- C. Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating and maintaining all doors under this section. Include manufacturer's brochures and parts lists describing the actual materials used in the product.

1.3 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Submit manufacturer's Underwriters Laboratories (UL), Warnock Hersey (WH) or Factory Mutual Research (FM) laboratory test report verifying product compliance in accordance with the required fire and smoke ratings.
 - 2. Provide manufacturer's ICC Evaluation Service report confirming compliance of the fire door assembly in accordance with the requirements of the Building Code.

1.4 QUALITY ASSURANCE

- A. Fire & Smoke Rated Assemblies: Provide all doors with fire and smoke resistance rating required to comply with governing regulations which are inspected, tested, listed and labeled by UL, WH or FM and complying with NFPA 80 for class of opening. Provide units tested in accordance with the requirements of UL 10B, UL 1784, NFPA 252, ASTM E-152. Provide testing laboratory label permanently fastened to each fire and smoke door assembly.
- B. Regulatory Requirements:
 - 1. Comply with applicable requirements of the laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.
 - 2. Listed by the ICC Evaluation Service in accordance with the applicable sections of the Building Code.
- C. Testing: Provide documentation from a certified testing agency that the fire door's self-closing governor mechanism and fire door operator have been tested for a minimum of 50,000 cycles and 500 self closing trip tests.
- D. Manufacturer Requirements: Door manufacturer shall have been in the business of and have experience in manufacturing the type of product covered under this specification section as well as giving credible service for a minimum of five (5) years. Provide list of at least ten (10) completed projects which include the products covered under this section.

1.5 DELIVERY, STORAGE AND HANDLING

- A. General: Deliver and store materials in manufacturer's original packaging, labeled to show name, brand and type. Store materials in a protected dry location off the ground in accordance with manufacturer's instructions.

1.6 WARRANTY

- A. Door Warranty: Furnish one (1) year written warranty signed by the manufacturer and installer agreeing to repair or replace work which has failed as a result of defects in materials or workmanship. Upon notification within the warranty period, such defects shall be repaired at no cost to the owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide side coiling 2 hour rated fire and smoke rated doors with integral egress door by McKeon Door Company; Safescape model S9000-G or comparable product approved by the Architect.

2.2 MATERIALS

- A. General: Each unit shall consist of an interlocking slat curtain designed to travel in a horizontal plane, smoothly and without binding. Curtain shall be driven to the open and close position by a positive action sprocket drive, without the use of cables or counterbalance weights.
 - 1. Curtain: Shall be fabricated of galvanized, interlocking, steel slats with an approximate cross section not less than 3 inches wide by 7/8 inches deep.
- B. Leading Edge: Curtain shall be furnished with a structural steel member of tubular design to provide stiffness, limit deflection and provide for a tight fitting closure.
- C. Receiving Edge: Shall be fabricated of a steel member with sufficient depth, designed to accept the leading edge and form a tight fitting closure when the door is the fully closed position.
- D. Swinging Egress Door: Incorporated within the curtain shall be a swinging type steel door designed and built as an integral part of the fire door's assembly.
 - 1. Door Frame: Shall be an all-steel unit type ASTM A366 hot rolled steel, 14 gauge with the same labeled fire resistance rating as specified for door.
 - 2. Door Assembly: Complete with door, hinge, and locking channel mechanism. 20 gauge stretcher leveled, electro galvanized and bonderized steel faces.
 - 3. Hardware:
 - a. Fire Exit Device: Flush mounted integral type fire exit device on one face and with pull handle on opposite face of the swinging door.
 - b. Closer: Shall be concealed type.
- E. Head Track: Shall be of not less than 1/8 inch thick steel and shall be provided with an integral locking bar. The faying surface shall not be less than 38 percent of the flat plate area when the door is in the closed position. Locking bar shall lock and retain the coiling curtain in place.
- F. Perimeter Smoke Seals: Provide internal, fully concealed UL Classified smoke seals located within the head track and coil box assembly. Externally mounted smoke seals shall not be acceptable.
- G. Counterbalance Assemblies: The fire door shall be counterbalanced by means of adjustable steel helical torsion springs attached to shaft enclosed in pipe with required mounting blocks for attachment of curtain. Torsion springs shall be anchored to the same shaft and held in position by the same adjusting wheel accessible from outside the barrel assemblies.

- H. Coil Box: Shall be provided to entirely enclose coiled curtain and counterbalance assemblies. Coil box cover shall be of a rectangular design fabricated of 22 gauge galvanized sheet steel.
- I. Electric Motor Operator: Fire door shall be provided with a compact power unit designed and built by the door manufacturer. Operator shall be equipped with an adjustable screw-type limit switch to break the circuit at termination of travel. High efficiency planetary gearing running in an oil bath, shall be furnished together with a centrifugal governor, magnetic operated brake and a fail-safe magnetic release device, completely housed to protect against damage, dust and moisture. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit. Operator is to be housed in a NEMA type 1 enclosure.
 - 1. Motor: Shall be intermediate duty, thermally protected, ball bearing type with a class A or better insulation with the following characteristics:
 - a. 110V
 - b. 1/2 HP
 - c. 1 Phase
 - d. 8 Amps
 - e. Fire Alarm Dry Contact (NC)
 - 2. Starter: Shall be size "0" magnetic reversing starter, across the line type with mechanical and electrical interlocks, with 10 amp continuous rating and 24 volt control circuit.
 - 3. Reducer: Planetary gear type, 80 percent efficiency minimum.
 - 4. Brake: Magnetically activated, integral within the operator's housing.
 - 5. Control Station: Provide flush mount key switch control station marked open, close and stop.
- J. Self-Closing Mechanism: The fire door is to be designed with a centrifugal governor as an integral part of the operator's construction. The automatic release mechanism shall be activated by smoke detector or fire alarm. When activated the door is released and begins to close due to the captured torsion spring force. The speed of the door shall be governed by a centrifugal governor, designed to match the normal operating speed of the door, at a rate of not greater than 9 inches per second or less than 6 inches per second. The fire door shall self-close under its own power. Battery back-up systems to achieve self-closing are not acceptable.
- K. Magnetic Release with 10 Second Time Delay: A fail-safe magnetic release device shall be built into the operator as an integral part of the release mechanism. When power is interrupted to the release mechanism by the smoke detector or fire alarm, the door shall begin to self-close. In the event of power failure the time delay shall prevent the fire door from closing for a period of 10 seconds. Once the 10 seconds have lapsed, the fire door shall self-close without the aid of electricity or battery back-up systems. Once power has been restored the automatic reset time delay as well as the fire door shall reset themselves.
- L. Obstruction Sensing Device: The fire door shall be designed with a radio activated obstruction sensing safety edge. In the event that the safety edge meets an obstruction during the normal closing operation, the door shall stop, reverse and return to the open position. In the event the safety edge meets an obstruction during the self-closing operation, the door shall reverse and attempt to close three times. In the event that the obstruction has not been removed during the third attempt, the door shall come to rest on the obstruction and once the obstruction has been removed the fire door shall continue to the fully closed position.
- M. Easy Trip Test Feature: The fire door shall be designed so that it may be trip tested simply by cutting power to the operator. By turning the power switch off, the door shall self-close. Once the fire door has satisfactorily closed, it shall be reset simply by turning the power back on. No ladders or tools shall be needed to reset the door or the time delay unit.

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- N. Finish: After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for paint adhesion. Curtain assembly is to receive a prime coat finish of .2 mils of epoxy primer and .8 mils of polyester paint in a gray finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and field conditions to which this work is to be performed and notify architect if conditions of surfaces exist which are detrimental to proper installation and timely completion of work.
- B. Verify all dimensions taken at job site affecting the work. Notify the architect in any instance where dimensions vary.
- C. Coordinate and schedule work under this section with work of other sections so as not to delay job progress.

3.2 INSTALLATION

- A. Perform installation using only factory approved and certified representatives of the door manufacturer.
- B. Install door assemblies at locations shown in perfect alignment and elevation, plumb, level, straight and true.
- C. Adjust door installation to provide uniform clearances and smooth non-binding operation.
- D. Install wiring in accordance with applicable local codes and the National Electrical Code Standard. Materials shall be UL listed.
- E. Test door closing sequence when activated by the building's fire alarm system. Reset door after successful test.

3.3 PROTECTION AND CLEANING

- A. Protect installed work using adequate and suitable means during and after installation until accepted by owner.
- B. Remove, repair or replace materials which have been damaged in any way.
- C. Clean surfaces of grime and dirt using acceptable and recommended means and methods.

END OF SECTION 083333

SECTION 084123 - FIRE RATED GLASS AND FRAMING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire rated door and framing systems for installation as vision lights in fire rated doors, full vision fire rated doors, sidelights, borrowed lights and transoms.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
2. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
3. ASTM E 283 - Test Method for Determining the Rate of Airflow through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
4. ASTM E 119 - Methods for Fire Tests of Building Construction and Materials.

B. National Fire Protection Association (NFPA):

1. NFPA 80: Standard for Fire Doors and Fire Windows.
2. NFPA 251: Standard Methods of Tests of Fire Endurance of Building Construction and Materials.
3. NFPA 252: Standard Methods of Fire Tests of Door Assemblies.
4. NFPA 257: Standard on Fire Test for Window and Glass Block Assemblies.

C. Underwriters Laboratories, Inc. (UL):

1. UL 9: Fire Tests of Window Assemblies.
2. UL 10B: Fire Tests of Door Assemblies.
3. UL 10C: Positive Pressure Fire Tests of Door Assemblies.
4. UL 263: Fire tests of Building Construction and Materials

D. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings.

E. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201 Categories I and II: Safety Standard for Architectural Glazing Materials.

1.3 PERFORMANCE REQUIREMENTS

A. Fire Rating: Match fire rating of construction where fire rated door and framing systems are installed.

1. Construction: Roll formed and profiled steel tubes, factory-welded or complete with mechanical joints for installation or shipped spliced for assembly at the Site or for fitting through available building openings. Knock down frames not acceptable.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data providing product descriptions and technical data.
- B. Shop Drawings: Show doors, frames, hardware and steel frame components.
- C. Samples: Submit following samples:
 - 1. Two 8-inch by 10-inch samples for glass.
- D. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Certificates of Compliance: Submit certificated from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
 - 1. Separate certification not required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
- B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Source Limitations for Glazing Accessories: Obtain framing system, glazing and glazing accessories from one source for each product and installation method indicated.
- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.
- E. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.
- F. Certification: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 - 1. Door assemblies shall be tested to the acceptance criteria of NFPA 252, UL 10-C Standard Methods of Fire Tests of Door Assemblies.
 - 2. Window assemblies shall be tested to the acceptance criteria of NFPA 257, UL 9 Standard methods for Fire Tests of Window Assemblies.
 - 3. Wall assemblies shall be tested to the acceptance criteria of ASTM E 119, NFPA 251, UL 263 Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 4. Underwriters Laboratories (UL) shall conduct fire test
- G. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by Underwriter Laboratory maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.
- H. Impact Safety Resistance: CPSC 16, CFR1201 (Cat. I and II).

- I. Pre-Installation Meeting: Conduct a pre-installation conference at least one week prior to the work of this section.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle under provisions specified by manufacturer.
- B. Deliver materials to specified destination in manufacturer or distributor's packaging undamaged.
- C. Store off ground, under cover, protected from weather and construction activities.

1.7 PROJECT CONDITIONS

- A. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.
 - 1. Note whether field or planned dimensions were used in the creation of the shop drawings.
- B. Coordinate the work of this section with others affected including, but not limited to, other interior components and door hardware not specified in this Section.

1.8 WARRANTY

- A. Manufacturer's Warranty: Provide fire rated door and framing system manufacturer's 5 year warranty dated from Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide the following products manufactured or distributed by Vetrotech – Fire-Rated Glass and Systems or an Architect approved equal product.

2.2 MATERIALS

- A. Interior Fire Rated Glazing: CONTRAFLAM by VETROTECH Saint-Gobain NA.
 - 1. Fire Rating: 120 minutes.
 - a. Manufacturer's Designation: CONTRAFLAM 120.
 - b. Glazing Type: Monolithic.
 - c. Nominal Thickness: 1 inch.
 - d. Weight: 11 lbs / sq. ft.
 - e. Clear, low iron.
 - 2. Fire Rating: 120 minutes.
 - a. Manufacturer's Designation: CONTRAFLAM STRUCTURE 120.
 - b. Glazing Type: Wireless, laminated glazing material with intumescent interlayers.
 - c. Nominal Thickness: 2-1/16 inch.
 - d. Weight: 13.0 lbs / sq. ft..
 - e. Clear, low iron.
- B. Steel Framing System: VDS FRAMING fire-rated steel frame system as manufactured by VETROTECH Saint-Gobain NA.
 - 1. Rating: 120 minutes.
 - 2. Compliance: NFPA 80, NFPA 251, NFPA 252, NFPA 257, UL 263, UL 10B, UL 10C.
 - 3. Finish: As indicated on Drawings.
 - 4. Steel Frame: Profiled steel tubing permanently joined with steel bolts.

5. Insulation: Insulate framing system against effects of fire, smoke, and heat transfer from either side. Insulate profiled steel tubing using a shell construction that incorporates PROMATECT intermediate interlayer. Firmly pack perimeter of framing system to rough opening with mineral wool fire stop insulation or appropriately rated intumescent sealant.
6. Steel Glazing Beads: rolled steel beads with dimensions recommended by manufacturer to securely hold glazing material in place.
7. Fasteners: Type recommended by manufacturer.
8. Glazing Accessories: Set CONTRAFLAM glass using calcium silicate or neoprene setting blocks.
9. Glaze CONTRAFLAM glass with glazing gaskets, compounds and tapes with the following:
 - a. Manufacturer approved pure silicone sealant.

2.3 FABRICATION

- A. Furnish frame assemblies pre-welded. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings. Knock-down perimeter frames are not permitted.
- B. Glaze door and frame assemblies in field, unless otherwise indicated.
- C. Factory-prepare steel door assemblies for field mounting of hardware.

2.4 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish frames after assembly.
- C. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and members to which fire rated door and framing systems attach or adjoin prior to frame installation.
- B. Provide openings plumb, square and within allowable tolerances. Provide 3/8 inch shim space at all walls
- C. Notify Architect of any conditions which compromise the integrity of the proposed fire wall / door system.
 1. Do not proceed until such conditions are corrected.

3.2 INSTALLATION

- A. Install fire rated door and framing systems in strict accordance with manufacturer's installation instructions and recommendations and accepted shop drawings.
- B. Install fire safing or fire stopping at edges of system
- C. Install glazing in strict accordance with fire-resistant glazing material manufacturer's specifications. Do not field cut or tamper with fire-resistant glazing material.

- D. Do not install damaged frames or chipped glassing units.
- E. Install plumb and true. Limit out of plumb or true to 1/8 inch in 10' feet in any dimension.

3.3 ADJUSTING

- A. Repair small scratches using manufacturer's recommended products and procedures. Match original finish for quality or material and view.
- B. Remove and replace broken, chipped, cracked, abraded, or damaged glass.
- C. Adjust door function and hardware for smooth operation. Coordinate with hardware suppliers for function and use of any other attached hardware.

3.4 PROTECTION AND CLEANING

- A. Protect glass from damage immediately after installation in accordance with fire rated door and framing system manufacturer's recommendations. Do not apply markers to glass surface. Remove non-permanent labels, and clean surfaces in accordance with fire rated door and framing system manufacturer's recommendations.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. Remove and replace contaminated glass immediately as recommended by glass manufacturer.
- C. Wash glass on both exposed surfaces in each area of Project not more than 4 days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

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SECTION 084423 - STRUCTURAL-SEALANT-GLAZED CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Site-glazed, two-sided structural-sealant-glazed curtain-wall assemblies.
2. Site-glazed, four-sided structural-sealant-glazed curtain-wall assemblies.
3. Exterior and interior manual-swing entrance doors.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.3 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. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Product Data for Recycled Content - Credit MR 4.1 and MR 4.2: Submit product data stating the percentage and cost of post-consumer and pre-consumer (post-industrial) recycled content by weight.
3. Product Data for Regional Materials - Credit MR 5.1 and MR 5.2: Submit a statement from aluminum manufacturer stating the distance between the place of extraction, harvesting, recovery and manufacturing and the Project location and the percentage by weight.

- ##### C. Shop Drawings: For structural-sealant-glazed curtain walls and entrances. Include plans, elevations at 1/2-inch equals 1-foot scale, 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. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
3. Include full-size isometric details of each vertical-to-horizontal intersection of structural-sealant-glazed curtain walls and interface with other adjacent envelope components, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - f. Custom fabricated components and correlation to air/vapor barrier, water drainage, sealants, weeps and thermal breaks.
 - g.
4. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Include site mockup Shop Drawings, showing details of site mockup.

- a. Resubmit Shop Drawings with changes made to details of structural-sealant-glazed curtain walls, to successfully complete preconstruction site testing.
- 6. Provide signature and seal by a structural engineer licensed in the State of Missouri stating compliance with Performance Requirements specified above.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
 - 1. Submit set of 2 samples of each specified aluminum finish showing extremes of color and appearance, minimum 4-inches long extrusions of specified alloys.
 - 2. Submit two 12-inch by 12-inch samples of each type of glazing specified.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- G. Delegated-Design Submittal: For structural-sealant-glazed 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.
- H. Other Action Submittals:
 - 1. Entrance Door Hardware Schedule: Prepared by or under the 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction Site Mockup Testing Submittals:
 - 1. Testing Program: Developed specifically for Project.
 - 2. Test Reports: Prepared by a qualified preconstruction testing agency, for each mockup test.
 - 3. Photographs:
 - a. Take a minimum of 20 photographs at locations and intervals as required by Architect.
 - b. Submit digital color images on CD-R of mockup before, during, and after preconstruction testing.
 - 4. Record Drawings: Submit record drawings of preconstruction laboratory mockups prepared by preconstruction laboratory testing agency.
- B. Qualification Data: For Installer and laboratory mockup testing agency and field testing agency.
- C. Seismic Qualification Certificates: For structural-sealant-glazed curtain walls, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

- D. Performance Certification: Submit written certification, signed by curtain wall system manufacturer, attesting that the curtain wall system installed conforms to the requirements specified in the "Performance Requirements" article ~~above~~ below (ADD 1-7) and that the manufacturer's standard system has been tested in accordance with specified tests, meeting all specified requirements.
 - 1. Submit a separate certification for thermal performance.
- E. Compatibility Certification - Operable Door Units: Submit written certification from curtain wall system manufacturer indicating that operable door units are fully compatible with the curtain wall system.
- F. Energy-Performance Certificates: For structural-sealant-glazed curtain walls, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy-performance values for each structural-sealant-glazed curtain wall.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for structural-sealant-glazed curtain walls, indicating compliance with performance requirements.
- H. Preconstruction Test Reports: For structural-sealant-glazed curtain walls and elastomeric glazing sealants.
- I. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- J. Source quality-control reports.
- K. Field quality-control reports.
- L. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for postinstallation-phase quality-control program.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for postinstallation-phase quality-control program.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Mockup Testing Agency Qualifications: Qualified according to ISO/IEC 17025 and accredited by ICC-ES for preconstruction testing indicated.
- C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for assemblies' aesthetic effects and performance characteristics. 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.

- E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- F. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of structural-sealant-glazed curtain walls.
- G. 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."
- H. 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, structural-sealant-glazed curtain walls with site fabrication certification letter.

1.7 MOCKUPS

- A. Mockups: ***Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance." Test mockups in accordance with Division 08 Section "Structural Sealant Glazed Curtainwall." Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.***

 - 1. ~~*Build mockups of typical wall area as shown on Drawings.*~~
 - 2. ~~*Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.*~~
 - 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. ~~*Mock ups to accurately represent project conditions including joint sizes, anchors, materials and finishes.*~~
 - 5. ~~*If failure occur, mock ups will be revised and retested. (ADD 1-2)*~~

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for structural-sealant-glazed curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Assembly Warranty: Standard form in which manufacturer and Installer agrees to repair or replace components of structural-sealant-glazed 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. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: 10 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 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing manufacturer's standard of structural-sealant-glazed curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Structural-sealant-glazed curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep and deflection from uniformly distributed and concentrated live loads.
 - 3. Failure also includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Glazing-to-glazing contact.
 - e. Glass breakage.
 - f. Noise or vibration created by wind and thermal and structural movements.
 - g. Loosening or weakening of fasteners, attachments, and other components.
 - h. Sealant failure.
 - i. Failure of operating units.
- B. Delegated Design: Design structural-sealant-glazed curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Periodic Maintenance-Equipment Loads: As indicated on Drawings.
 - 3. Other Design Loads: As indicated on Drawings.
- D. Structural-Test Performance: Provide structural-sealant-glazed curtain walls tested according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

- E. Deflection of Framing Members: At design wind pressure, as follows:
 - 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 amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 - 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4-inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches
- F. Curtainwall Movement Joint: Stack mullions for movement joints to accommodate structure deflection, thermal movement and loading conditions. Provide minimal and flush appearance at the face. Stack mullion detail should be continuous at horizontal datum all around curtainwall, unless noted otherwise.
- G. Seismic Performance: Structural-sealant-glazed curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. Component Importance Factor is as indicated on the drawings.
 - 2. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
 - 3. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.
- H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
 - 1. Design Displacement: As indicated on Drawings.
 - 2. Test Performance: Meets criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.
- I. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..
- J. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Test Interior Ambient-Air Temperature: 75 deg F.
 - 3. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.
- K. Energy Performance: Structural-sealant-glazed curtain walls shall have certified and labeled energy performance ratings according to NFRC.
 - 1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a SHGC of no greater than 0.40 as determined according to NFRC 200.

3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of ~~0.60~~ **0.06 (ADD 1-7)** cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft..
 4. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified CR rating of no less than 65 as determined according to NFRC 500
- L. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
- M. Structural-Sealant Joints:
1. Designed to carry gravity loads of glazing.
 2. Designed to produce tensile or shear stress of less than 20 psi.
 3. Design reviewed and approved by structural-sealant manufacturer.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide EFCO Corporation as follows:
1. EGS-1: EFCO 5600 Series 2-1/2 inch system.
 - a. 8 inch deep two sided SSG system with vertical snap covers.
 - b. Color: Match Reynobond, Colorweld 500, "Pewter".
 - c. Glass Types: GLE-3 & GLE-4.
 2. EGS-2: EFCO 5600 Series 2-1/2 inch system.
 - a. 6 inch deep four sided SSG system.
 - b. Color: Match Reynobond, Colorweld 500, "Pewter".
 - c. Glass Types: GLE-1 & GLE-2.
 3. EGS-2A: EFCO 5600 Series 2-1/2 inch system.
 - a. 6 inch deep four sided SSG system utilizing 1-3/8 **(nominal) (ADD 1-7)** thick laminated glass, sound batts at mullions and differing color on mullions.
 - b. Color: As selected by Architect.
 - c. Glass Types: GLE-5.
 - d. **Notify Architect 24 hours prior to placement of insulation so acoustical engineer can observe installation of sound batts in mullions. (ADD 1-2)**
 4. EGS-3: EFCO 5600 Series 2-1/2 inch system.
 - a. 5 inch deep four sided SSG.
 - b. Color: Match Reynobond, Colorweld 500, "Pewter".
 - c. Glass Types: GLE-1 & GLE-2.
 5. Entrance Doors: EFCO D300 medium stile entrance doors.
- B. Source Limitations: Obtain all components of curtain-wall system, including framing entrances and accessories, from single manufacturer.

- C. Acceptable additional manufacturer's contingent upon compliance with performance requirements:

1. **Oldcastle Building Envelope (ADD 1-2)**
2. Kawneer
3. Wausau Window and Wall Systems

2.3 FRAMING

- A. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Glazing System: Retained with structural sealant on four sides or retained mechanically with gaskets on two sides and structural sealant on two sides.
 2. Finish: High-performance organic finish.
 3. Fabrication Method: Either factory- or field-fabricated system.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Materials
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429.
 - d. Custom extrusions to be as indicated on the drawings and per approved shop drawings.
 - e. Structural Profiles: ASTM B 308/B 308M.
 - f. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
 - g. Recycled Content of Aluminum Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.
 - h. Regional Materials: To the greatest extent possible, provide aluminum that has been extracted, harvested or recovered and manufactured within 500 miles of the Project.
 2. 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.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
- D. Framing Sealants: Manufacturer's standard sealants with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING

- A. Glazing: Comply with Division 08 Section "Glazing."
- B. Glazing Gaskets, Spacers, Setting Blocks, Sealant Backings, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types compatible with sealants and suitable for joint movement and assembly performance requirements.
- C. Glazing Sealants: For structural-sealant-glazed curtain walls, as recommended by manufacturer for joint type, and as follows:

1. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
 - a. Sealant shall have a VOC content of 250 g/L or less.
 - b. Color: As selected by Architect from manufacturer's full range of colors.
2. Weatherseal Sealant: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
 - a. Sealant shall have a VOC content of 250 g/L or less.
 - b. Color: Matching structural sealant.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors – Aluminum-Framed Glass Panel: Manufacturer's standard glazed entrance doors for manual-swing operation.
 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-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.
 2. Door Design: Medium stile; 3-1/2-inch nominal width.
 - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.6 ACCESSORY MATERIALS

- 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, fabricated from Series 300 stainless steel.
- B. Anchors: Three-way adjustable anchors, with minimum adjustment of 1 inch, that accommodate fabrication and installation tolerances in material and finish and are 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-thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

- E. Cleaning Agent and Cloth: As recommended by structural-sealant manufacturer.
- F. Perimeter Fire-Resistive Joint Systems: For joints between edges of fire-resistance-rated floor assemblies and curtain wall system framing, provide systems of type and ratings indicated on Drawings and complying with requirements specified in Division 07 Section "Fire-Resistive Joint Systems."
 - 1. Provide integrity ratings equal to, or exceeding, fire-resistance rating of floor or floor/ceiling assembly forming one side of joint and having the required joint width and movement classification and L-rating.

2.7 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. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - 6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels. Include accommodations for using temporary support device (dutchman) to retain glazing in place while sealant cures.
 - 7. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within structural-sealant-glazed curtain wall to exterior.
- D. Factory-Assembled Frame Units:
 - 1. Rigidly secure nonmovement joints.
 - 2. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
 - 3. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 4. Seal joints watertight unless otherwise indicated.
 - 5. Install glazing to comply with requirements in Division 08 Section "Glazing."
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
 - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- 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. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Three -coat metallic 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: Two custom colors to be selected by Architect.

2.9 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, 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 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 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 nonmoving joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
 - 6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
 - 7. 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, 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 structural-sealant-glazed curtain walls to exterior.
- D. Install components plumb and true in alignment with established lines and grades.

- E. Install glazing as specified in Division 08 Section "Glazing." Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- F. Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- G. 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.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install to comply with the following nonaccumulating maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 ADJUSTING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
 - 1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Testing and inspecting of representative areas of structural-sealant-glazed curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.
 - 1. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - a. Test a minimum of 10% of glass openings at each floor on each building facade.
 - b. Repair installation areas damaged by testing.

2. Waterproofing Sealant Adhesion: Use Destructive Procedure Tail Method "A" and frequency of testing as defined by ASTM C1521. Interior (primary) sealant to be tested and remediated prior to placing secondary (exterior) sealant bead. Exterior sealant to also be tested for adhesion.
3. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article, but not more than 0.50 cfm/sq. ft., of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft..
 - a. Test Area: Mock up.
4. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
 - a. Test Area: Mock up.
5. 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. Test Area:
 - 1) North, South and West Elevations: perform tests on floor to floor height x three lite wide EGS 1&2 at levels 02, 03, and 04.
 - 2) East Elevation: perform tests on floor to floor height x three lite wide EGS 1&2 at levels 02, 03, and 04 located within metal panel and brick cladding.
 - 3) **West Elevation: perform tests on floor to floor height x three lite wide EGS 2A at level 01, courtyard. (ADD 1-2)**
 - b. Perform tests in each test area as directed by Architect. .
- C. Structural-sealant-glazed curtain walls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 084423

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SECTION 087100 - DOOR HARDWARE

1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including Division 01 Specification Section, apply to the work of this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware for the following:
 - a. Interior doors.
 - b. Exterior and storefront doors.
 - c. Other doors to the extent indicated.
 - 2. Electrified door hardware.
- B. Coordinate the requirements of this Section with those of other sections that interface with finish hardware, particularly:
 - 1. Division 8 Section 08 11 00 "Metal Doors and Frames."
 - 2. Division 8 Section 08 14 00 "Wood Doors."
 - 3. Division 8 Section 08 41 00 "Aluminum Entrances and Storefronts."
 - 4. Division 8 Section 08 74 00 "Access Control Hardware"
 - 5. Division 26 "Electrical"
 - 6. Division 28 "Electronic Safety and Security"

1.3 SUBMITTALS

- A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: If directed by Architect to do so, submit samples for exposed door hardware, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.
 - 1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- C. Door Hardware Schedule: Prepared by or under the supervision of a certified Architectural Hardware Consultant (AHC) employed by the hardware distributor, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. The hardware schedule shall be signed and embossed with the DHI certification seal of the supervising AHC. The supervising AHC shall attend any meetings related to the project when requested by the architect. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Submittals not using this format will be rejected.
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets matching the Drawings and these specifications indicating complete designations of every item required for each door or opening.

- a. Use same identifying "set numbers" given in this Section. Coordinate submittal with doors and frames submittals and use same "opening number" identification as given on Drawings and in the Door Schedule.
 - b. Submittals not using numbering identification system shown on Architect's Drawings and Schedules will be rejected.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
 - i. Wiring Diagrams in accordance with Fire Detection and Alarm Section 28 13 00 Submittals as follows:
 - 1) Elevation Drawing with Finish Hardware Schedule
 - 2) Riser Diagram with Approved and Revised Finish Hardware Schedule
 - 3) Point to Point Wiring Diagrams after Low Voltage Meeting
 4. Architect's approval of schedule does not relieve Contractor of responsibility for furnishing all items specified or obviously required to complete the work or as required by job conditions, including screws, bolts, expansion shields, or other devices necessary or required for proper installation.
 5. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
 6. Furnish with first submittal, a list of required lead times for all hardware items.
- D. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 01.
- F. Warranties: Special warranties specified in this Section.
- G. Shop Drawings: Details of electrified door hardware, indicating details for wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring. Detail interface between hardware and fire alarm or security system.
- H. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- I. Fire Door Assembly Inspection and Testing: Submit a written report of the results of functional testing and inspection for fire door assemblies, in compliance with NFPA 80-2007/2010 requirements. Written report shall be provided to the Owner to be made available to the Authority Having Jurisdiction (AHJ). Report shall include the door number for each fire door assembly, door location, door and frame material, fire rating, and summary of deficiencies.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed door hardware 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. **Supplier Qualifications:** Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. **Electrified Door Hardware Supplier Qualifications:** An Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, function, and extent to the indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
 - a. **Electrified Door Hardware Supplier Engineering Responsibility:** Prepare data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- C. **Regulatory Requirements:** Comply with provisions of the following:
 - 1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), and "Accessibility Guidelines for Buildings and Facilities (ADAAG)".
 - 2. NFPA 101: Compliance required for means of egress doors.
 - 3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
 - 4. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- D. **Single Manufacturer:** Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- E. **Keying Conference:** After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of the initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and field use in quantities as required by Division 01 - General Conditions. Determine during the meeting who will take receipt of the permanent key and cores if applicable.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Delivery and Storage:** Contractor is responsible for inventorying the door hardware on receipt and providing secure lock-up for door hardware delivered to Project site.
- B. **Handling:** Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. **Packaging:** All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.
- D. **Key Delivery:** Deliver keys to the contact determined during the keying conference by registered mail or overnight package service.
- E. **Permanent Core Delivery:** Deliver permanent cores to the contact determined during the keying conference by registered mail or overnight package service.

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, and other related systems.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation. Do not order hardware until the submittal has been reviewed by the frame and door suppliers for compatibility with their products.

1.7 PRE-INSTALATION MEETING

- A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.
- B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Door Hardware Distributor representative, Manufacturers representative for above hardware items, and any other effected subcontractors or suppliers.
- C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Repairs and Replacements: Upon notice from Owner or Architect, promptly repair or replace defective items together with any work affected in correcting such defects, at no additional cost to the Owner.
- C. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of operators and door hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- D. Warranty Period:
 - 1. Door Closers (Surface): Thirty (30) year period
 - 2. Exit Devices: Three (3) year period
 - 3. Automatic Door Operators: Two (2) year period
 - 4. Locks: Ten (10) year period
 - 5. Cylinders: Three (3) year period

1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

- B. Parts kits: Furnish manufacturer's standard parts kits for locksets, exit devices, and door closers.
- C. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 - 2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.
 - 3. Basis of Design Products: Where Specifications name a product, or refer to a scheduled product 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. Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - b. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - c. Evidence that proposed product provides specified warranty.
 - d. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - e. Samples, if requested.
 - 4. Product, Manufacturer: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements. Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 - 5. Owner's Standard: Where Specifications refer to a product or manufacturer as an owner standard, substitutions are not allowed.

2.2 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: 6063-T6 Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; an Allegion company, or a comparable product by:
 - a. Hager Companies.
 - b. Zero International.
 - 2. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by a testing agency acceptable to the authority having jurisdiction.
 - 3. Provide aluminum geared continuous hinges with factory fabricated cut outs for electrified power transfer where specified.

2.3 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 - 1. Provide Non-Removable Pin (NRP) Hinges at exterior and outswing doors.
 - 2. Provide Steel base or Stainless-steel base at all fire rated doors
 - 3. Provide Stainless-steel base material at exterior doors unless specified to use non-ferrous base material.
 - 4. Provide ball bearing hinges with 5 knuckles at all doors
 - 5. Provide hinges with 4 ½-inch width unless other width is required due to frame and/or trim requirements.
 - 6. Provide hinges with 4 ½-inch height for door widths up to 3' 6", provide hinges with 5-inch height for door widths 3' 6" and over.
 - 7. Provide standard weight hinges for door heights up to 8 feet, provide heavy weight hinges for door heights over 8 feet and up to 10 feet
 - 8. Provide two (2) hinges for doors up to 60-inches, provide an additional hinge for each additional 30-inches of door height or fraction thereof.
 - 9. Provide one (1) additional hinge at dutch doors than required for height.
- B. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; an Allegion company, or a comparable product by:
 - a. Bommer Industries, Inc.
 - b. Hager Companies.

2.4 PIVOTS

- A. Pivots: Conforming to BHMA A156.4.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; an Allegion company, or a comparable product by:
 - a. DORMA.
 - b. Rixson; an ASSA ABLOY Group Company

2.5 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. High-Security Lock Cylinders: BHMA A156.30, Grade 1.

1. "Primus" High Security key system, PROVIDED by hardware supplier and INSTALLED by Owner, to match existing keying system.
- C. Cylinders: Manufacturer's standard; finish face to match lockset with interchangeable cores.
- D. Construction Keying: Comply with the following:
 1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
 - a. Provide cost break-out, for the "Primus" permanent cores to G.C. as Alternate, for Owner's use.
- E. Manufacturer: Schlage - no substitutions accepted.

2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into master key system.
 1. Existing System: Re-Key Owner's existing master key system into new keying system, if required in Hardware Schedule.
- B. Keys: Nickel silver: Permanently inscribed with a visual key control number and including the notation "DO NOT DUPLICATE."
 1. Quantity: In addition to one extra key blank for each lock, provide three cylinder change keys and five master keys.

2.7 MECHANICAL LOCKS AND LATCHES

- A. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
- B. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
 1. Specified Product: Subject to compliance with requirements, provide product manufactured by Schlage Commercial Lock Division; an Allegion company, no substitutions accepted.

2.8 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3. Grade 1; certified by independent testing lab for minimum 1,000,000 cycles; listed by UL for accident and hazard; and conforming to applicable requirements of NFPA 80 and NFPA 101.
 1. Provide roller strikes for rim and surface vertical rod exit devices.
 2. Internal springs: Coil compression type
 3. Provide security dead latching for active latch bolts
 4. Latch Bolts: Self lubricating coating to reduce friction and wear. Plated latchbolts are not acceptable.
 5. Provide flush end caps
 6. Provide dead-latching latch bolts
 7. Touch Pad: Stainless steel with return stroke fluid dampers and rubber bottoming dampers.
 8. Provide filler plates and shim kits as needed for flush mounting of devices on doors.
 9. Devices with exposed rivets or screws on back of device that would be visible through a glass light are not acceptable.
- B. Specified Product: Subject to compliance with requirements, provide product manufactured by Von Duprin; an Allegion company, no substitutions accepted.

2.9 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm.
 - 1. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use.
 - 2. Provide closers, constructed with high strength cast iron cylinders, forged main arms, and one piece forged steel pistons.
 - 3. Provide factory-sized closers that are adjustable to meet field conditions and requirements for opening force.
 - 4. Provide closers with full complement bearings.
 - 5. Closers with pressure release valves are not acceptable.
 - 6. Mount closers on room side (non-corridor) unless conditions will not permit the proper installation and use of the closer or unless otherwise specified.
 - 7. On exterior doors, always mount closers on building interior (protected) side unless otherwise specified.
 - 8. Provide all necessary plates, spacers, and brackets for proper installation.
 - 9. Where closers are paired with an overhead stop, or an "ST" number is specified, contact manufacturer for special templating to coordinate installation of hardware.
 - 10. Special Requirement: At Toilet Room Doors, force to open door should be less than 4lbs including initial force required to overcome inertia of door.
- B. Specified Product: Subject to compliance with requirements, provide product manufactured by LCN Closers; an Allegion company, no substitutions accepted.

2.10 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; an Allegion company, or comparable product by one of the following:
 - a. Trimco; a Triangle Brass Manufacturing Co., Inc. company.
 - b. Hager Companies

2.11 COORDINATORS

- A. Coordinators: Provide bar-type coordinating device, surface applied to underside of stop at frame head, where pairs of doors are equipped with automatic or constant latching flush bolts, an astragal, or other hardware that requires synchronized closing of the doors.
- B. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factor-prep coordinators for vertical rod devices if required.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; an Allegion company, or comparable product by one of the following:
 - a. Burns.
 - b. Rockwood; an ASSA ABLOY Group Company.

2.12 LOW ENERGY ELECTRO-MECHANICAL AUTOMATIC OPERATORS

- A. Electro-Mechanical Operators: Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards. Operators shall comply with ANSI A156.19, UL 325, and the American with Disabilities Act.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled products manufactured by LCN Closers; an Allegion company, or comparable product by one of the following:
 - a. Besam; an ASSA ABLOY Group company.
 - b. Horton Automatics; HD-Swing 4000LE Series

2.13 AUTOMATIC OPERATOR ACTUATORS

- A. Actuators: hardwired low voltage actuator with rectangle, recessed/flush mounted, stainless steel touch plate 1 ½" x 4 1/2". Engraved blue filled handicap symbol and text conforming to accessibility codes. Designed to mount in a flush mount box in/on a vertical surface near the controlled door. Constructed with heavy industrial grade components designed for vandal resistant mounting and manufactured with weather resistant switch.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by LCN Hardware; an Allegion company, or comparable product by one of the following:
 - a. Stanley Commercial Hardware; Div. of The Stanley Works.
 - b. Horton Automatics.

2.14 SLIDING DOOR HARDWARE

- A. Sliding door tracks: meeting BHMA A156.14-2013
 - 1. Track to be manufactured from Aluminum
 - 2. Provide brackets, manufactured from stainless steel, as required for the installation
 - 3. Provide two (2) hangers, manufactured from nylon or stainless steel as specified
 - 4. Provide two (2) door stops per leaf
 - 5. Provide one (1) guide per leaf suitable to the requirements of the installation
- B. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by Brio: an Allegion company, or equal by approved substitution request.
- C. Provide Sliding Door lock, as specified manufactured by Accurate Lock.
- D. Provide Edge Pulls, as specified manufactured by Reveal Designs.

2.15 ELECTRIC STRIKES

- A. Electric Strikes: UL Listed as burglary-resistant.
- B. Where required, provide electric strikes UL Listed for fire doors and frames.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by Von Duprin; an Allegion company, or comparable product by one of the following:
 - a. HES; an ASSA ABLOY Group company.
 - b. Adams Rite; an ASSA ABLOY Group company.

2.16 ELECTRIC POWER TRANSFER

- A. Electric Power Transfer: Provide power transfer with number and gage of wires sufficient to accommodate electric function of specified hardware located per manufacturer's template and UL requirements.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by Von Duprin; an Allegion company, or comparable product by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc – PT200/PT1000 series.
 - b. Securitron; an ASSA ABLOY Group company – CEPT series.

2.17 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; an Allegion company, or comparable product by one of the following:
 - a. Baldwin Hardware Corporation.
 - b. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2.18 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by Glynn-Johnson; an Allegion company, or comparable product by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. Rockwood Manufacturing Company; an ASSA ABLOY Group company

2.19 PROTECTION PLATES

- A. Kick plates, mop plates, and armor plates: minimum of 0.050 inch thick as scheduled with four beveled edges. Furnish with sheet metal or wood screws, finished to match plates.
- B. Sizes of plates:
 - 1. Kick Plates: 10 inches high by 2 inches less width of door on single doors, 1 inch less width of door on pairs
 - 2. Mop: 4 inches high by 1 inch less width of door on single doors and pairs
 - 3. Armor Plates: 36 inches high by 2 inches less width of door on single doors, 1 inch less width of door on pairs
 - 4. Manufacturers: Subject to compliance with requirements, provide the scheduled product or comparable product by one of the following:
 - a. Ives; an Allegion Company
 - b. Trimco.
 - c. Hiawatha

2.20 SILENCERS:

- A. General: Provide silencers as scheduled, and where the frame does not have an integral weather seal or where another type of seal along the head and jamb is not called for.
- B. Metal Frames
 - 1. Specified: Ives; an Allegion Company SR 64: (3) per single leaf opening, (2) per double leaf opening.

C. Wood Frames

1. Specified: Ives; and Allegion Company SR 65: (3) per single leaf opening, (2) per double leaf opening.

2.21 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Self-adhesive seals to utilize 3M brand of adhesive tape
2. Where specified, provide extrusions with bulb finger to compensate for any warping and misalignment
3. Gasketing to be manufactured from same material(s) as the specified product.
4. Automatic door bottoms to be rated to 5 million cycles.
5. Seals provided for light tight doors to be field cut and installed accurately and with tight tolerances.

- B. Manufacturers: Subject to compliance with requirements, provide the scheduled product or comparable product by one of the following:

- a. K. N. Crowder.
- b. Reese Enterprises, Inc.
- c. Zero International.

2.22 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide the scheduled product or comparable product by one of the following:
 - a. K. N. Crowder.
 - b. Reese Enterprises, Inc.
 - c. Zero International.

2.23 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.24 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Mounting Heights: Mount door hardware units at heights indicated or as required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
- C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- D. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
 - 2. Furnish permanent cores to Owner for installation.
- F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic. Stops that are a component part of the door closer do meet the requirement to provide door stops.
- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Light tight Gasketing: Head and Jamb seals to be field cut and installed for accurate installation and with tight tolerances.
- L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- M. 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.

3.2 FIELD INSPECTIONS

- A. Independent Architectural Hardware Consultant: Contractor will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
- B. Fire Door Assembly Inspection and Testing: Provide functional testing and inspection of fire door assemblies in accordance with NFPA 80-2007/2010. Inspections shall be performed by individuals certified by Intertek as a Fire Door Assembly Inspector, using reporting forms provided by the Door and Hardware Institute (DHI). Alternatively, inspections may be performed by individuals acceptable to the Architect, who have knowledge and understanding of the operating components of the applicable door type, and who have experience in preparing written reports of testing and inspection results.
 1. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project.
 2. Submit a signed, written final report as specified in Section 1.3 - SUBMITTALS.
 3. Contractor shall correct all deficiencies and schedule a reinspection of fire door assemblies which were noted as deficient on the inspection report.
 4. Inspector shall reinspect fire door assemblies after repairs are made.
 5. Additional reinspections which are required due to incomplete repairs will be performed by the inspector at the expense of the Contractor.

3.3 DOOR HARDWARE SCHEDULE

HARDWARE GROUP NO. 01
FOR USE ON MARK/DOOR #(S):

230B 272A 475 S076 S176.2 S494A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	DOOR SWEEP	339AA X CUSTOM POWDER COAT	AA	ZER

HARDWARE GROUP NO. 01A
FOR USE ON MARK/DOOR #(S):

210B 300B 310 400B 410

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	DOOR SWEEP	339AA X CUSTOM POWDER COAT	AA	ZER

HARDWARE GROUP NO. 02
FOR USE ON MARK/DOOR #(S):

X172.2 X178.2 X188 X192.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	628	IVE
1	SET	CONST LATCHING BOLT	FB51P 24"	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH SRI MC	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	25A X 144A X CUSTOM POWDER COAT	AL	ZER
1	EA	GASKETING	188S-CL	S-CL	ZER
2	EA	ASTRAGAL	328AA X EBF X CUSTOM POWDER COAT	AA	ZER
2	EA	DOOR SWEEP	339AA X CUSTOM POWDER COAT	AA	ZER
1	EA	THRESHOLD	657A-V3-226	A	ZER
1	EA	RAIN DRIP	142A X CUSTOM POWDER COAT	A	ZER

HARDWARE GROUP NO. 03
FOR USE ON MARK/DOOR #(S):

XS176.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	628	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH SRI MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	25A X 144A X CUSTOM POWDER COAT	AL	ZER
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	DOOR SWEEP	339AA X CUSTOM POWDER COAT	AA	ZER
1	EA	THRESHOLD	657A-V3-226	A	ZER
1	EA	RAIN DRIP	142A X CUSTOM POWDER COAT	A	ZER

HARDWARE GROUP NO. 04
FOR USE ON MARK/DOOR #(S):
X160.3

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD X CUSTOM POWDER COAT	628	IVE
1	EA	PANIC HARDWARE	LD-9975-EO	626	VON
1	EA	SURFACE CLOSER	4040XP SCUSH SRI MC X CUSTOM POWDER COAT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	25A X 144A X CUSTOM POWDER COAT	AL	ZER
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	DOOR BOTTOM	3551A6	A	ZER
1	EA	THRESHOLD	233A-226	A	ZER
1	EA	THRESHOLD	236A-226	A	ZER
1	EA	RAIN DRIP	11A X CUSTOM POWDER COAT	A	ZER

HARDWARE GROUP NO. 05
FOR USE ON MARK/DOOR #(S):

S194 S294 S394 S494

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	9975-L-BE-F-06-SNB	626	VON
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	DOOR SWEEP	339AA X CUSTOM POWDER COAT	AA	ZER

HARDWARE GROUP NO. 06
FOR USE ON MARK/DOOR #(S):

184 187 195 292.2 389.1 478.1
489.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 06A
FOR USE ON MARK/DOOR #(S):

282.1 292.1 386.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 06B
FOR USE ON MARK/DOOR #(S):

176

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER

HARDWARE GROUP NO. 07
FOR USE ON MARK/DOOR #(S):

192.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	9975-L-NL-F-17	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER

**HARDWARE GROUP NO. 08
FOR USE ON MARK/DOOR #(S):**

151 175 185 186 272B 372C
375

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

**HARDWARE GROUP NO. 08A
FOR USE ON MARK/DOOR #(S):**

100B 110A 110B 112

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

**HARDWARE GROUP NO. 09
FOR USE ON MARK/DOOR #(S):**

160D 210A 310B 312

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 10
FOR USE ON MARK/DOOR #(S):

180 182 275

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY W/ INDICATOR	L9056T 06A L583-363 L283-722	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	COAT AND HAT HOOK	572	626	IVE

NOTE: SET CLOSER AT SIZE 1 FOR OWNER REQUIREMENTS

HARDWARE GROUP NO. 11
FOR USE ON MARK/DOOR #(S):

177 179 277 279 377 379
477 479

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 6" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

NOTE: SET CLOSER AT SIZE 1 FOR OWNER REQUIREMENTS

HARDWARE GROUP NO. 12
FOR USE ON MARK/DOOR #(S):
172.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	FB51P 24"	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS401/402CCV	626	IVE
2	EA	ASTRAGAL	328AA X EBF X CUSTOM POWDER COAT	AA	ZER
2	EA	DOOR SWEEP	339AA X CUSTOM POWDER COAT	AA	ZER

HARDWARE GROUP NO. 12A
FOR USE ON MARK/DOOR #(S):
178.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	SET	CONST LATCHING BOLT	FB51P 24"	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS401/402CCV	626	IVE
2	EA	ASTRAGAL	328AA X EBF X CUSTOM POWDER COAT	AA	ZER
2	EA	DOOR SWEEP	339AA X CUSTOM POWDER COAT	AA	ZER
2	EA	DOOR BOTTOM	3551A6	A	ZER
1	EA	THRESHOLD	657A-V3-226	A	ZER

HARDWARE GROUP NO. 13
FOR USE ON MARK/DOOR #(S):

133B 372B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO N123-062 CON	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O
1	EA	WIRE HARNESS	CON-192		VON

OPERATION: VALID CREDENTIAL TO RELEASE ELECTRIC STRIKE ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 13A
FOR USE ON MARK/DOOR #(S):

137 183A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO N123-062 CON	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O
1	EA	WIRE HARNESS	CON-192		VON

OPERATION: VALID CREDENTIAL TO RELEASE ELECTRIC STRIKE ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 13B
FOR USE ON MARK/DOOR #(S):
231

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	628	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO N123-062 CON	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	DOOR BOTTOM	3551A6	A	ZER
1	EA	THRESHOLD	657A-V3-226	A	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O
1	EA	WIRE HARNESS	CON-192		VON

OPERATION: VALID CREDENTIAL TO RELEASE ELECTRIC STRIKE ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

NOTE: SOUND SEALS REQUIRED.

HARDWARE GROUP NO. 13C
FOR USE ON MARK/DOOR #(S):
274

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO N123-062 CON	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	475AA	AA	ZER
1	EA	DOOR BOTTOM	3551A6	A	ZER
1	EA	THRESHOLD	566A-226	A	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O
1	EA	WIRE HARNESS	CON-192		VON

OPERATION: VALID CREDENTIAL TO RELEASE ELECTRIC STRIKE ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

NOTE: DOOR REQUIRES LIGHT TIGHT SEALS. ENSURE ALL SEALS ARE CUT ACCURATELY AND WITH TIGHT TOLERANCES.

HARDWARE GROUP NO. 14
FOR USE ON MARK/DOOR #(S):

276.1	283.1	291.1	374A	383.1	388.1
472.1	483.1				

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO N123-062 CON	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O
1	EA	WIRE HARNESS	CON-192		VON

OPERATION: VALID CREDENTIAL TO RELEASE ELECTRIC STRIKE ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 14A
FOR USE ON MARK/DOOR #(S):

133A	135.1	332.2	353
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EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU STOREROOM LOCK	ND80TDEU RHO N123-062 CON	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O
1	EA	WIRE HARNESS	CON-192		VON

OPERATION: VALID CREDENTIAL TO RELEASE ELECTRIC STRIKE ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 15
FOR USE ON MARK/DOOR #(S):
183B.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	EU STOREROOM LOCK	ND80TDEU RHO N123-062 CON	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
2	EA	ASTRAGAL	328AA X EBF X CUSTOM POWDER COAT	AA	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O
2	EA	WIRE HARNESS	CON-192		VON

OPERATION: VALID CREDENTIAL TO RELEASE ELECTRIC STRIKE ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 16
FOR USE ON MARK/DOOR #(S):
183B.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	OH STOP	100S	630	GLY
2	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 17
FOR USE ON MARK/DOOR #(S):

172A 183C

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE

HARDWARE GROUP NO. 18
FOR USE ON MARK/DOOR #(S):

114	116	131	135.2	174	282.2
282.3	289A.1	289A.2	289B.1	289B.2	352
374B	386.2	386.3	389.2	389.3	400A
478.2	478.3	489.2	489.3		

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 18A
FOR USE ON MARK/DOOR #(S):

140.1 140.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	CONCEALED CLOSER	2033 ST-2211 WMS	689	LCN
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 19
FOR USE ON MARK/DOOR #(S):

154 156.1 160A 203

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 19A
FOR USE ON MARK/DOOR #(S):

156.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 19B
FOR USE ON MARK/DOOR #(S):

233 235

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	628	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 20
FOR USE ON MARK/DOOR #(S):
C270

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL+-9947-WDC-L-DT-F-06-CON	626	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL+-9947-WDC-L-NL-F-06-CON	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
2	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	ASTRAGAL	328AA X EBF X CUSTOM POWDER COAT	AA	ZER
2	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL	LGR	VON
2	EA	WIRE HARNESS	CON-192		VON

HARDWARE GROUP NO. 20A
FOR USE ON MARK/DOOR #(S):
C153

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7212 SET	626	IVE
2	EA	INTERMEDIATE PIVOT	7212 INT	626	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-2-QEL+-3349A-EO-CON	626	VON
1	EA	ELEC PANIC HARDWARE	RX-2-QEL+-3349A-NL-OP-388-CON	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	DOOR PULL	RM 3340 MEGATEK 60" CTC	315	ROC
2	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
2	EA	ACTUATOR	8310-818T	630	LCN
2	EA	WALL STOP	WS401/402CCV	626	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL	LGR	VON
2	EA	WIRE HARNESS	CON-192		VON

OPERATION: VALID CREDENTIAL OR ACCESS CONTROL SYSTEM TO ELECTRICALLY DOG EXIT DEVICES. WHEN ACTIVE LEAF IS ELECTRICALLY DOGGED, RX SWITCH TO ALLOW EXTERIOR ACTUATORS TO BE ACTIVE. PRESSING ACTUATOR WHEN ACTIVE CYCLES ACTIVE LEAF. WHEN ACTIVE LEAF IS UNDOGGED, RX SWITCH TO SHUNT EXTERIOR ACTUATORS. PRESSING INTERIOR ACTUATOR ELECTRICALLY RETRACTS LATCH AND CYCLES AUTO OPERATOR. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 20B
FOR USE ON MARK/DOOR #(S):
150

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	TWO PT EL MORT LOCK	LM9291ELEL 06A	626	SCH
1	EA	TWO PT EL MORT LOCK	LM9295ELTEL 06A	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
2	EA	WALL STOP	WS401/402CCV	626	IVE
2	EA	SILENCER	SR64	GRY	IVE
2	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL	LGR	VON
2	EA	WIRE HARNESS	CON-192		VON

HARDWARE GROUP NO. 20C
FOR USE ON MARK/DOOR #(S):
C170

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	POCKET PIVOT	91105F	630	IVE
2	EA	FIRE EXIT HARDWARE	9447-L-BE-F-06	626	VON
2	EA	SURFACE CLOSER	4003T WMS	689	LCN
2	EA	FIRE/LIFE WALL MAG	SEM7840	689	LCN
1	EA	GASKETING	188S-CL	S-CL	ZER
2	EA	ASTRAGAL	328AA X EBF X CUSTOM POWDER COAT	AA	ZER

HARDWARE GROUP NO. 21
FOR USE ON MARK/DOOR #(S):
100A 200A 300A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	TRACK	SR180-57GN-1SS-106RB/94-94P/94PA- 180DS	AL	BRI
1	EA	POCKET DOOR LOCK	SD-2001SDL-3-S2002T-S2002C-2 3/4	630	ACC
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	EDGE PULL	690	630	RED

HARDWARE GROUP NO. 22
FOR USE ON MARK/DOOR #(S):

101	104	105	106	107	108
109	111	113	115	117	144
205	206	207	208	209	211
212	214	304	305.1	305.2	306
311	313	314	315	316	317
318	319	320	321	322	323
325	327	329	331	333	335
337	342	344	346	348	360
362	364	372D	401	402	403
404	405	406	407.1	407.2	411
412	413	414	415	416	417
432	433	434	435	437	439
441	452	454	456		

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	COAT AND HAT HOOK	572	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	COAT HOOK	CH23	US26D	MOC

HARDWARE GROUP NO. 22A
FOR USE ON MARK/DOOR #(S):
160B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	DOOR BOTTOM	3551A6	A	ZER
1	EA	THRESHOLD	657A-V3-226	A	ZER
1	EA	COAT AND HAT HOOK	572	626	IVE
1	EA	COAT HOOK	CH23	US26D	MOC

HARDWARE GROUP NO. 23
FOR USE ON MARK/DOOR #(S):

215 332.1 419

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 24
FOR USE ON MARK/DOOR #(S):

160.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9947-WDC-L-F-LBR-ADJ10-06	626	VON
2	EA	RIM HOUSING	20-079	626	SCH
2	EA	PRIMUS CORE	20-740	626	SCH
2	EA	SURFACE CLOSER	4040XP RW/PA MC [MOUNT VESTIBULE SIDE]	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
2	EA	ASTRAGAL	328AA X EBF X CUSTOM POWDER COAT	AA	ZER

HARDWARE GROUP NO. 25
FOR USE ON MARK/DOOR #(S):

160.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
2	EA	DUMMY PUSH BAR	330-L-DT-06	626	VON
1	EA	SURFACE CLOSER	4040XP RW/PA MC [MOUNT VESTIBULE SIDE]	689	LCN
1	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	MEETING STILE	36AA	AA	ZER

HARDWARE GROUP NO. 26
FOR USE ON MARK/DOOR #(S):

276.2 283.2 291.2 483.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	EXIT X BLANK OUTSIDE	ND25D RHO	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 27
FOR USE ON MARK/DOOR #(S):

202

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 28
FOR USE ON MARK/DOOR #(S):

C210

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 29
FOR USE ON MARK/DOOR #(S):
C230A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PIVOT SET	7215 SET	626	IVE
1	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-33A-NL-OP-388-CON	626	VON
1	EA	RIM HOUSING	20-079	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	DOOR PULL	RM 3340 MEGATEK 60" CTC	315	ROC
1	EA	OH STOP	100S	630	GLY
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
1	EA	THRESHOLD	657A-V3-226	A	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O

NOTE: SEALS AND SWEEPS BY STOREFRONT MANUFACTURER.

OPERATION: VALID CREDENTIAL OR ACCESS CONTROL SYSTEM TO ELECTRICALLY DOG EXIT DEVICES. WHEN ACTIVE LEAF IS ELECTRICALLY DOGGED, RX SWITCH TO ALLOW EXTERIOR ACTUATORS TO BE ACTIVE. PRESSING ACTUATOR WHEN ACTIVE CYCLES ACTIVE LEAF. WHEN ACTIVE LEAF IS UNDOGGED, RX SWITCH TO SHUNT EXTERIOR ACTUATORS. PRESSING INTERIOR ACTUATOR ELECTRICALLY RETRACTS LATCH AND CYCLES AUTO OPERATOR. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 30
FOR USE ON MARK/DOOR #(S):
C250A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7215 SET	626	IVE
2	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-2-QEL+-3349A-EO-CON	626	VON
1	EA	ELEC PANIC HARDWARE	RX-2-QEL+-3349A-NL-OP-388-CON	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	DOOR PULL	RM 3340 MEGATEK 60" CTC	315	ROC
1	EA	SURFACE CLOSER	4040XP SCUSH MC	689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
1	EA	ACTUATOR	8310-818T	630	LCN
1	EA	ACTUATOR	8310-855	630	LCN
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	POWER SUPPLY	BY ACCESS CONTROL		B/O
1	EA	POWER SUPPLY	PS904 900-4RL	LGR	VON
2	EA	WIRE HARNESS	CON-192		VON

NOTE: SEALS, ASTRAGAL, AND SWEEPS BY STOREFRONT MANUFACTURER.

OPERATION: VALID CREDENTIAL TO RETRACT LATCHES ALLOWING ENTRY AND TRIGGERING RX SWITCH. WHEN ACTIVE LEAF IS ELECTRICALLY DOGGED, RX SWITCH TO ALLOW EXTERIOR ACTUATOR TO BE ACTIVE. PRESSING EXTERIOR ACTUATOR WHEN ACTIVE CYCLES ACTIVE LEAF. RX SWITCH TO SHUNT EXTERIOR ACTUATORS WHEN EXIT DEVICE IS NOT RETRACTED. INTERIOR ACTUATOR IS ALWAYS ACTIVE AND RETRACTS ELECTRIC LATCH PRIOR TO CYCLING AUTO OPERATOR. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 31
FOR USE ON MARK/DOOR #(S):

284.1	284.2	378.1	378.2	383.2	388.2
391.1	391.2	472.2	480.1	480.2	488.1
488.2	491.1	491.2			

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 32
FOR USE ON MARK/DOOR #(S):
S340.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188S-CL	S-CL	ZER
1	EA	DOOR SWEEP	339AA X CUSTOM POWDER COAT	AA	ZER

HARDWARE GROUP NO. 33
FOR USE ON MARK/DOOR #(S):
376

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	RIM HOUSING	20-079	626	SCH
			AS REQ'D		
1	EA	MORTISE CYLINDER	26-064	626	SCH
			AS REQ'D		
1	EA	PRIMUS CORE	20-740	626	SCH

NOTE: ALL HARDWARE BY DOOR MANUFACTURER

END OF SECTION 087100

SECTION 087100.01 – STOREFRONT DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including Division 01 Specification Section, apply to the work of this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware for the following:
 - a. Interior doors.
 - b. Exterior and storefront doors.
 - c. Other doors to the extent indicated.
 - 2. Electrified door hardware.
- B. Coordinate the requirements of this Section with those of other sections that interface with finish hardware, particularly:
 - 1. Division 8 Section 08 11 00 "Metal Doors and Frames."
 - 2. Division 8 Section 08 14 00 "Wood Doors."
 - 3. Division 8 Section 08 41 00 "Aluminum Entrances and Storefronts."
 - 4. Division 8 Section 08 74 00 "Access Control Hardware"
 - 5. Division 26 "Electrical"
 - 6. Division 28 "Electronic Safety and Security"

1.3 SUBMITTALS

- A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: If directed by Architect to do so, submit samples for exposed door hardware, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.
 - 1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- C. Door Hardware Schedule: Prepared by or under the supervision of a certified Architectural Hardware Consultant (AHC) employed by the hardware distributor, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. The hardware schedule shall be signed and embossed with the DHI certification seal of the supervising AHC. The supervising AHC shall attend any meetings related to the project when requested by the architect. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "*Sequence and Format for the Hardware Schedule*." Submittals not using this format will be rejected.
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets matching the Drawings and these specifications indicating complete designations of every item required for each door or opening.

- a. Use same identifying "set numbers" given in this Section. Coordinate submittal with doors and frames submittals and use same "opening number" identification as given on Drawings and in the Door Schedule.
 - b. Submittals not using numbering identification system shown on Architect's Drawings and Schedules will be rejected.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
 - i. Wiring Diagrams in accordance with Fire Detection and Alarm Section 28 13 00 Submittals as follows:
 - 1) Elevation Drawing with Finish Hardware Schedule
 - 2) Riser Diagram with Approved and Revised Finish Hardware Schedule
 - 3) Point to Point Wiring Diagrams after Low Voltage Meeting
 4. Architect's approval of schedule does not relieve Contractor of responsibility for furnishing all items specified or obviously required to complete the work or as required by job conditions, including screws, bolts, expansion shields, or other devices necessary or required for proper installation.
 5. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
 6. Furnish with first submittal, a list of required lead times for all hardware items.
- D. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 01.
- F. Warranties: Special warranties specified in this Section.
- G. Shop Drawings: Details of electrified door hardware, indicating details for wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring. Detail interface between hardware and fire alarm or security system.
- H. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- I. Fire Door Assembly Inspection and Testing: Submit a written report of the results of functional testing and inspection for fire door assemblies, in compliance with NFPA 80-2007/2010 requirements. Written report shall be provided to the Owner to be made available to the Authority Having Jurisdiction (AHJ). Report shall include the door number for each fire door assembly, door location, door and frame material, fire rating, and summary of deficiencies.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has completed door hardware 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. **Supplier Qualifications:** Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. **Electrified Door Hardware Supplier Qualifications:** An Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, function, and extent to the indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
 - a. **Electrified Door Hardware Supplier Engineering Responsibility:** Prepare data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- C. **Regulatory Requirements:** Comply with provisions of the following:
 - 1. Where indicated to comply with accessibility requirements, comply with *Americans with Disabilities Act (ADA)*, and "Accessibility Guidelines for Buildings and Facilities (ADAAG)".
 - 2. *NFPA 101*: Compliance required for means of egress doors.
 - 3. **Electrified Door Hardware:** Listed and labeled as defined in *NFPA 70*, Article 100, by a testing agency acceptable to authorities having jurisdiction.
 - 4. **Fire-Rated Door Assemblies:** Provide door hardware for assemblies complying with *NFPA 80* that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to *NFPA 252*.
- D. **Single Manufacturer:** Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- E. **Keying Conference:** After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of the initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and field use in quantities as required by Division 01 - General Conditions. Determine during the meeting who will take receipt of the permanent key and cores if applicable.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Delivery and Storage:** Contractor is responsible for inventorying the door hardware on receipt and providing secure lock-up for door hardware delivered to Project site.
- B. **Handling:** Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. **Packaging:** All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.
- D. **Key Delivery:** Deliver keys to the contact determined during the keying conference by registered mail or overnight package service.

- E. Permanent Core Delivery: Deliver permanent cores to the contact determined during the keying conference by registered mail or overnight package service.

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, and other related systems.
- C. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
 - 1. Location of embedded and attached items to concrete.
 - 2. Location of wall-mounted hardware, including wall stops.
 - 3. Location of finish floor materials and floor-mounted hardware.
 - 4. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
 - 5. Manufacturer templates to door and frame fabricators.

1.7 PRE-INSTALLATION MEETING

- A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.
- B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Door Hardware Distributor representative, Manufacturers representative for above hardware items, and any other effected subcontractors or suppliers.
- C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Repairs and Replacements: Upon notice from Owner or Architect, promptly repair or replace defective items together with any work affected in correcting such defects, at no additional cost to the Owner.
- C. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of operators and door hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

D. Warranty Period:

- | | |
|------------------------------|-------------------------|
| 1. Door Closers (Surface): | Thirty (30) year period |
| 2. Exit Devices: | Three (3) year period |
| 3. Automatic Door Operators: | Two (2) year period |
| 4. Cylinders: | Three (3) year period |

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
- Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 - Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
- Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
 - References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.
 - Basis of Design Products: Where Specifications name a product, or refer to a scheduled product 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. Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - Evidence that proposed product provides specified warranty.
 - List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - Samples, if requested.
 - Product, Manufacturer: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements. Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 - Owner's Standard: Where Specifications refer to a product or manufacturer as an owner standard, substitutions are not allowed.

2.2 PIVOTS

- A. Pivots: Conforming to BHMA A156.4.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by IVES Hardware; an Allegion company, or a comparable product by:
 - a. DORMA.
 - b. Rixson; an ASSA ABLOY Group Company

2.3 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. High-Security Lock Cylinders: BHMA A156.30, Grade 1.
 - 1. "Primus" High Security key system, PROVIDED by hardware supplier and INSTALLED by Owner, to match existing keying system.
- C. Cylinders: Manufacturer's standard; finish face to match lockset with interchangeable cores.
- D. Construction Keying: Comply with the following:
 - 1. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
 - a. Provide cost break-out, for the "Primus" permanent cores to G.C. as Alternate, for Owner's use.
- E. Manufacturer: Schlage - no substitutions accepted.

2.4 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into master key system.
 - 1. Existing System: Re-Key Owner's existing master key system into new keying system, if required in Hardware Schedule.
- B. Keys: Nickel silver: Permanently inscribed with a visual key control number and including the notation "DO NOT DUPLICATE."
 - 1. Quantity: In addition to one extra key blank for each lock, provide three cylinder change keys and five master keys.

2.5 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3. Grade 1; certified by independent testing lab for minimum 1,000,000 cycles; listed by UL for accident and hazard; and conforming to applicable requirements of NFPA 80 and NFPA 101.
 - 1. Provide roller strikes for rim and surface vertical rod exit devices.
 - 2. Internal springs: Coil compression type
 - 3. Provide security dead latching for active latch bolts
 - 4. Latch Bolts: Self lubricating coating to reduce friction and wear. Plated latchbolts are not acceptable.
 - 5. Provide flush end caps
 - 6. Provide dead-latching latch bolts
 - 7. Touch Pad: Stainless steel with return stroke fluid dampers and rubber bottoming dampers.
 - 8. Provide filler plates and shim kits as needed for flush mounting of devices on doors.
 - 9. Devices with exposed rivets or screws on back of device that would be visible through a glass light are not acceptable.

- B. Specified Product: Subject to compliance with requirements, provide product manufactured by Von Duprin; an Allegion company, no substitutions accepted.

2.6 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm.
 - 1. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use.
 - 2. Provide closers, constructed with high strength cast iron cylinders, forged main arms, and one piece forged steel pistons.
 - 3. Provide factory-sized closers that are adjustable to meet field conditions and requirements for opening force.
 - 4. Provide closers with full complement bearings.
 - 5. Closers with pressure release valves are not acceptable.
 - 6. Mount closers on room side (non-corridor) unless conditions will not permit the proper installation and use of the closer or unless otherwise specified.
 - 7. On exterior doors, always mount closers on building interior (protected) side unless otherwise specified.
 - 8. Provide all necessary plates, spacers, and brackets for proper installation.
 - 9. Where closers are paired with an overhead stop, or an "ST" number is specified, contact manufacturer for special templating to coordinate installation of hardware.
- B. Specified Product: Subject to compliance with requirements, provide product manufactured by LCN Closers; an Allegion company, no substitutions accepted.

2.7 LOW ENERGY ELECTRO-MECHANICAL AUTOMATIC OPERATORS

- A. Electro-Mechanical Operators: Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards. Operators shall comply with ANSI A156.19, UL 325, and the American with Disabilities Act.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled products manufactured by LCN Closers; an Allegion company, or comparable product by one of the following:
 - a. Besam; an ASSA ABLOY Group company.
 - b. Horton Automatics; HD-Swing 4000LE Series

2.8 AUTOMATIC OPERATOR ACTUATORS

- A. Actuators: hardwired low voltage actuator with round, stainless steel touch plate 4 1/2" (114mm) diameter. Engraved blue filled handicap symbol and text conforming to accessibility codes. Designed to mount in a flush or surface mount box in/on a vertical surface near the controlled door. Constructed with heavy industrial grade components designed for vandal resistant mounting and manufactured with weather resistant switch.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by LCN Hardware; an Allegion company, or comparable product by one of the following:
 - a. Stanley Commercial Hardware; Div. of The Stanley Works.
 - b. Horton Automatics.

2.9 ELECTRIC POWER TRANSFER

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- A. Electric Power Transfer: Provide power transfer with number and gage of wires sufficient to accommodate electric function of specified hardware located per manufacturer's template and UL requirements.
 - 1. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by Von Duprin; an Allegion company, or comparable product by one of the following:
 - a. Architectural Builders Hardware Mfg., Inc – PT200/PT1000 series.
 - b. Securitron; an ASSA ABLOY Group company – CEPT series.

2.10 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
 - 1. Saddle thresholds to be a minimum of 0.200" thick
 - 2. Bumper seal thresholds to be a minimum of 0.125" thick
- B. Specified Product: Subject to compliance with requirements, provide scheduled product manufactured by Zero International; an Allegion Company, or comparable product by one of the following:
 - a. K. N. Crowder.
 - b. Reese Enterprises, Inc.

2.11 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.12 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Mounting Heights: Mount door hardware units at heights indicated or as required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

2. Custom Steel Doors and Frames: HMMA 831.
 - C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - D. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
 - E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 1. Replace construction cores with permanent cores as directed by Owner.
 2. Furnish permanent cores to Owner for installation.
 - F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.
 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
 - G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
 - H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic. Stops that are a component part of the door closer do meet the requirement to provide door stops.
 - I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
 - K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
 - L. 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.
- 3.2 FIELD INSPECTIONS
- A. Independent Architectural Hardware Consultant: Contractor will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - B. Fire Door Assembly Inspection and Testing: Provide functional testing and inspection of fire door assemblies in accordance with NFPA 80-2007/2010. Inspections shall be performed by individuals certified by Intertek as a Fire Door Assembly Inspector, using reporting forms provided by the Door and Hardware Institute (DHI). Alternatively, inspections may be performed by individuals acceptable to the Architect, who have knowledge and understanding of the operating components of the applicable door type, and who have experience in preparing written reports of testing and inspection results.
 1. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project.

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2. Submit a signed, written final report as specified in Section 1.3 - SUBMITTALS.
3. Contractor shall correct all deficiencies and schedule a reinspection of fire door assemblies which were noted as deficient on the inspection report.
4. Inspector shall reinspect fire door assemblies after repairs are made.
5. Additional reinspections which are required due to incomplete repairs will be performed by the inspector at the expense of the Contractor.

3.3 DOOR HARDWARE SCHEDULE

HARDWARE GROUP NO. 01
FOR USE ON MARK/DOOR #(S):
XC130

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PIVOT SET	7215 SET [COLOR TO MATCH STOREFRONT]	626	IVE
2	EA	INTERMEDIATE PIVOT	7215 INT [COLOR TO MATCH STOREFRONT]	626	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL+-33A-NL-OP-388-CON	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	90 DEG OFFSET PULL	8190HD 10" O	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH MC	689	LCN
1	EA	THRESHOLD	657A-V3-226	A	ZER
1	EA	CREDENTIAL READER	BY ACCESS CONTROL		B/O
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS904 900-4RL	LGR	VON

NOTE: SEALS AND SWEEPS BY STOREFRONT MANUFACTURER.
OPERATION: VALID CREDENTIAL OR AUTOMATED ACCESS CONTROL TO RETRACT
ELECTRIFIED LATCHING ALLOWING ENTRY. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 02
FOR USE ON MARK/DOOR #(S):
XC153

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7215 SET	626	IVE
4	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	PANIC HARDWARE	3349A-EO	626	VON
1	EA	PANIC HARDWARE	3349A-NL-OP-388	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10" O	630	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH MC	689	LCN
1	EA	THRESHOLD	657A-V3-226	A	ZER

NOTE: SEALS, ASTRAGAL, AND SWEEPS BY STOREFRONT MANUFACTURER.

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HARDWARE GROUP NO. 03
FOR USE ON MARK/DOOR #(S):
X201.2 X201.3

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7215 SET	626	IVE
4	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	PANIC HARDWARE	3349A-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-3349A-NL-OP-388	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10" O	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH MC	689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
1	EA	THRESHOLD	657A-V3-226	A	ZER

NOTE: SEALS, ASTRAGAL, AND SWEEPS BY STOREFRONT MANUFACTURER.

OPERATION: WHEN ACTIVE LEAF IS MECHANICALLY DOGGED, RX SWITCH TO ALLOW ACTUATORS TO BE ACTIVE. PRESSING ACTUATOR WHEN ACTIVE CYCLES ACTIVE LEAF. WHEN ACTIVE LEAF IS UNDOGGED, RX SWITCH TO SHUNT ACTUATORS. DOGGING EXIT DEVICES ALLOWS PUSH/PULL OPERATION OF DOORS. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 04
FOR USE ON MARK/DOOR #(S):
XC200A.2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	PIVOT SET	7215 SET	626	IVE
2	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	PANIC HARDWARE	3349A-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-3349A-NL-OP-388	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 10" O	630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH MC	689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
1	EA	THRESHOLD	657A-V3-226	A	ZER

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NOTE: SEALS, ASTRAGAL, AND SWEEPS BY STOREFRONT MANUFACTURER.

OPERATION: WHEN ACTIVE LEAF IS MECHANICALLY DOGGED, RX SWITCH TO ALLOW ACTUATORS TO BE ACTIVE. PRESSING ACTUATOR WHEN ACTIVE CYCLES ACTIVE LEAF. WHEN ACTIVE LEAF IS UNDOGGED, RX SWITCH TO SHUNT ACTUATORS. DOGGING EXIT DEVICES ALLOWS PUSH/PULL OPERATION OF DOORS. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 05
FOR USE ON MARK/DOOR #(S):
XC250A.1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PIVOT SET	7215 SET [COLOR TO MATCH STOREFRONT]	626	IVE
1	EA	INTERMEDIATE PIVOT	7215 INT [COLOR TO MATCH STOREFRONT]	626	IVE
1	EA	ELEC PANIC HARDWARE	RX-33A-NL-OP-388	626	VON
1	EA	MORTISE CYLINDER	26-064	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	90 DEG OFFSET PULL	8190HD 10" O	630	IVE
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
1	EA	THRESHOLD	657A-V3-226	A	ZER

NOTE: SEALS AND SWEEPS BY STOREFRONT MANUFACTURER.

OPERATION: WHEN EXIT DEVICE IS MECHANICALLY DOGGED, RX SWITCH TO ALLOW ACTUATORS TO BE ACTIVE. PRESSING ACTUATOR WHEN ACTIVE CYCLES DOOR LEAF. WHEN EXIT DEVICE IS UNDOGGED, RX SWITCH TO SHUNT ACTUATORS. DOGGING EXIT DEVICE ALLOWS PUSH/PULL OPERATION OF DOOR. FREE EGRESS AT ALL TIMES.

END OF SECTION 087100.01

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Glazed curtain walls.
 - 4. Glazed entrances.
 - 5. Interior borrowed lites.

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.3 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: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Design Snow Loads: As indicated on Drawings.
 - 3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 - 4. 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, whichever is less.
 - 5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Safety Glazing: Provide safety glazing at all locations indicated by chapter 24 of the 2006 International Building Code, whether indicated on the drawings or not.

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing will not be 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 sufficient 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.

1.5 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Sustainability Submittals:
 - 1. Product Data for VOC Content: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass and glazing products, from manufacturer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass glazing sealants and glazing gaskets.
- C. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer: ~~Qualifications for Insulating Glass Units with Sputter Coated, Low-E Coatings: A qualified insulating glass manufacturer who is approved and certified by coated glass manufacturer~~ Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI / ASQC 9002 1994. (ADD #1)
- B. 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.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

- D. Source Limitations for Glass: Obtain ~~coated float glass laminated glass and insulating glass from single source from single manufacturer for each glass type glass and glazing materials from one source for each product indicated.~~ **Coatings and finished assemblies, such as insulating units and laminated units, to be manufactured by the same fabricator in order to have a common source of warranty. (ADD #1)**
 - E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
 - F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
 - G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 - H. 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 for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.
 - I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
 - J. Mockups: **Construct mockups in accordance with this Section and Division 01 Section "Quality Assurance." Test mockups in accordance with Division 08 Section "Structural Sealant Glazed Curtainwall."** ~~Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.~~
 - 1. ~~Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion. (ADD #1)~~
 - K. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.
- 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 recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT 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 below 40 deg F

1.10 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of ~~Substantial Completion~~ **date of manufacture. (ADD #1)**
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which 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~~ **date of manufacture.**
- C. **Manufacturer's Special Warranty on Ceramic Frit: Manufacturer's standard form in which ceramic frit glass manufacturer agrees to replace ceramic frit glass units that deteriorate due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.**
 - 1. **Warranty Period: 10 years from date of manufacture.**
- D. **Manufacturer's Special Warranty on Sputter Coating: Manufacturer's standard form in which sputter coated glass manufacturer agrees to replace sputter coated glass units that deteriorate due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer's published instructions.**
 - 1. **Warranty Period: 10 years from date of manufacture.**
- E. **Manufacturer's Special Warranty on Fully Tempered Glass: Manufacturer's standard form in which tempered glass manufacturer agrees to replace tempered glass units have been heat soaked and that heat soaked glass will not spontaneously break as a result of Nickel Sulfide inclusions at a rate exceeding 0.5%.**
 - 1. **Warranty Period: 5 years from date of manufacture. (ADD #1)**

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - a. Maximum peak to valley rollerwave 0.003 inches in the central area and 0.008 inches within 10.5 inches of the leading and trailing edge.
 - b. ***For clear or low-iron glass 1/4 inch to 3/8 inch thick without ceramic frit or ink, maximum + or – 100mD (millidiopter) over 95% of the glass surface.***
 - c. ***Maximum bow and warp 1/32 inch per lineal foot.***
 - d. ***All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.***
 - e. ***For all fully tempered glass, provide heat soak testing conforming to EN14179 which includes a 2 hour dwell at 290 dC + or – 10 dC. (ADD #1)***
 2. For uncoated glass, comply with requirements for Condition A.
 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
- C. Ceramic-Coated Vision Glass: Heat-treated float glass, Condition C; with ceramic enamel applied by silk-screened process; complying with Specification No. 95-1-31 in GANA's Tempering Division's "Engineering Standards Manual" and with other requirements specified.
 1. Glass: Clear float.
 2. Ceramic Coating Color and Pattern: As indicated in the Drawings and in the Finish Legend.
- D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.
 1. Glass: Clear float.
 2. Ceramic Coating Color: As selected by Architect from manufacturer's full range .

2.3 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. 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 to comply with interlayer manufacturer's written recommendations.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.4 INSULATING GLASS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary.
 - 2. Spacer: Aluminum with black, color anodic finish .
- C. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.5 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- B. Monolithic Ceramic Glazing: Clear (no amber tinting), ceramic flat glass; 1/4-inch nominal thickness, impact safety rated.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Technical Glass Products; FireLite Plus standard 5/16 inch 60 minute.
- C. Fire-Protection-Rated Tempered Glass: 1/4-inch-thick, fire-protection-rated tempered glass, complying with testing requirements in 16 CFR 1201 for Category II materials.

2.6 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from the following:
 - 1. Silicone complying with ASTM C 1115.

2.7 GLAZING SEALANTS

- A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will 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. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with 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. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. Pecora Corporation; 890.
 - d. Sika Corporation, Construction Products Division; SikaSil-C990.
 - e. Tremco Incorporated; Spectrem 1.
- C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.
- D. Glazing Sealant Color: Use black sealant for all insulating glass units.

2.8 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 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. 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.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, 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~~ **100% silicone** with a Shore, Type A durometer hardness of 85, plus or minus 5. **(ADD #1)**

- 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.

2.10 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.
- 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.
- D. Do not attempt to cut, seam, nip or abrade tempered glass.

2.11 MONOLITHIC-GLASS TYPES

- A. Refer to Finish Legend in the Drawings for interior glazing types.

2.12 LAMINATED-GLASS TYPES

- A. Refer to Finish Legend in the Drawings for interior glazing types.

2.13 INSULATING-GLASS TYPES

- A. Glass Type GLE-1: Clear insulating glass.
 - 1. Basis of Design: Viracon VNE 1-63.
 - 2. Overall Unit Thickness: 1 inch maximum.
 - 3. Thickness of Each Glass Lite: 6.0 mm minimum.
 - 4. Outdoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 - 5. Interspace Content: Air.
 - 6. Indoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 - 7. Winter Nighttime U-Factor: 0.29 maximum.
 - 8. Summer Daytime U-Factor: 0.26 maximum.
 - 9. Solar Heat Gain Coefficient: 0.29 maximum.
 - 10. Visible Light Transmittance: ~~66%~~ 62% (**ADD #1**)
 - 11. Low-e coating on #2 surface.
- B. Glass Type GLE-2: Clear insulating spandrel glass.
 - 1. Basis of Design: Viracon VNE 1-63
 - 2. Overall Unit Thickness: 1 inch maximum.

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3. Thickness of Each Glass Lite: 6.0 mm minimum.
 4. Outdoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 5. Interspace Content: Air.
 6. Indoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 7. Winter Nighttime U-Factor: 0.29 maximum.
 8. Summer Daytime U-Factor: 0.26 maximum.
 - ~~9. Solar Heat Gain Coefficient: 0.29 maximum. (ADD #1)~~
 10. Low-e coating on #2 surface and ceramic coating on #4 surface.
 11. Ceramic Coating Color: "Gray", (from Viracon standard colors).
- C. Glass Type GLE-3: Clear insulating glass with silkscreened frit on 40% of glass surface.
1. Basis of Design: Viracon VNE 1-63.
 2. Overall Unit Thickness: 1 inch maximum.
 3. Thickness of Each Glass Lite: 6.0 mm minimum.
 4. Outdoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 5. Interspace Content: Air.
 6. Indoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 7. Winter Nighttime U-Factor: 0.29 maximum.
 8. Summer Daytime U-Factor: 0.26 maximum.
 9. Solar Heat Gain Coefficient: ~~0.21 at frit area~~ 0.20 maximum.
 10. Visible Light Transmittance: ~~40% at frit area~~ 38%. (ADD #1)
 11. Low-e coating on #2 surface.
 12. Silkscreened ceramic dot screen on #2 surface: 40% coverage with 1/8 inch dot screen – color "Gray", (from Viracon standard colors). Refer to drawings for location of dot screens.
- D. Glass Type GLE-4: Clear insulating spandrel glass with silkscreened frit on 40% of glass surface.
1. Basis of Design: Viracon VNE 1-63
 2. Overall Unit Thickness: 1 inch maximum.
 3. Thickness of Each Glass Lite: 6.0 mm minimum.
 4. Outdoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 5. Interspace Content: Air.
 6. Indoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 7. Winter Nighttime U-Factor: 0.29 maximum.
 8. Summer Daytime U-Factor: 0.26 maximum.
 - ~~9. Solar Heat Gain Coefficient: 0.29 maximum. (ADD #1)~~
 10. Low-e coating on #2 surface and ceramic coating on #4 surface.
 11. Silkscreened ceramic dot screen on #2 surface: 40% coverage with 1/8 inch dot screen – color "Gray", (from Viracon standard colors). Refer to drawings for location of dot screens.
- E. Glass Type GLE-5: Clear insulating laminated glass lite.
1. Basis of Design: Viracon VNE 1-63.
 2. Overall Unit Thickness: ~~1-3/8~~ 1-7/16 inch. (ADD #1)
 3. Thickness of Each Glass Lite: 6.0 mm minimum.
 4. Outdoor Lite: Fully tempered laminated float glass, 1/4 inch lite, PVB layer and 3/8 inch lite.
 5. Interspace Content: Air 1/2 inch.
 6. Indoor Lite: Heat-strengthened float glass (Fully tempered float glass, as required).
 7. Winter Nighttime U-Factor: 0.29 maximum.
 8. Summer Daytime U-Factor: 0.26 maximum.

9. Solar Heat Gain Coefficient: 0.29.
10. Low-e coating on ~~#3~~ #4 surface. **(ADD #1)**
11. PVB Layer: 0.060 clear PVB.

2.14 INTERIOR GLAZING TYPES.

- A. GLI-1A: 3/8 inch clear tempered glass. **(BP #3)**
 1. **Custom Printed Film: Applied in locations identified on EG series drawings. See Division 10 Section "Signage" for film.**
- ~~B. GLI-1B: 3/8 inch clear tempered glass with film applied.~~
 - ~~1. Film: Custom printed translucent film. Full height of graphic files provided.~~
 - ~~2. Location: Office fronts in IGS-1.~~
- ~~C. GLI-1C: 3/8 inch clear tempered glass with film applied to inside surface.~~
 - ~~1. Film: Custom printed translucent film. Full height of graphic files provided. (BP #3)~~
- D. GL-3: 1/4 inch clear tempered glass.
- E. GLI-4: 5/8 inch clear tempered glass.
 1. Location: ~~Classroom and Conference~~ glazing in IGS-3.
 2. **Custom Printed Film: Applied in locations identified on EG series drawings. See Division 10 Section "Signage" for film. (BP #3)**
- F. GLI-5: Fire-Rated safety glass: 120 minute rating.
 - ~~1. Basis of Design: Vetrotech Contraflam Structure with butt glazed joints.~~
 2. **Refer to Division 08 Section "Fire Rated Glass and Framing Systems. (BP #3)**
- G. GLI-6: Fire-Rated safety glass: 120 minute rating.
 - ~~1. Basis of Design: Vetrotech Contraflam.~~
 2. **Refer to Division 08 Section "Fire Rated Glass and Framing Systems. (BP #3)**
- H. GLI-7: Fire-Rated safety glass for use in limited door openings.
- I. GLI-8: 1-3/8 inch clear ~~insulating glass lite~~ **insulated glass used on interior for acoustical separation.**
 - ~~1. Basis of Design: Viracon VNE 1-63.~~
 2. **Overall Thickness: 1-3/8 inches.**
 3. **Corridor Side Lite: Tempered laminated float glass, 1/4 inch lite, PVB layer, 3/8 inch heat strengthened lite.**
 4. **Interspace: 1/2 inch air.**
 5. **Indoor Lite: 1/4 inch tempered clear glass.**
 6. **Custom Printed Film: Applied in locations identified on EG series drawings. See Division 10 Section "Signage" for film. (BP #3)**
- J. **GLI-9: 3/4 inch clear tempered glass for use with IGS-5. (BP #3)**
- K. **GLI-10: 1/4 inch clear tempered low iron glass. (BP #3)**
- L. **GLI-11: 5/8 inch clear tempered laminated glass for doors**
 1. **Outer Lite: 1/4 inch glass.**
 2. **Interlayer: 0.030 PVB.**
 3. **Inner Lite: 3/8 inch glass. (BP #3)**

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. Inspect each glass unit immediately before installation. Do not install units with edge damage or face imperfections.
- C. 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 will 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.
 - 1. Where glass is installed in other building components, comply with requirements of component manufacturer for installation of glass in the applicable building component.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- 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.

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 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.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. 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.
- D. Install gaskets so they protrude past face of glazing stops. Where sealant is indicated with gaskets, slightly recess gasket to receive sealant.

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 air pockets and voids, other than expansion 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.
- D. Promptly after installation, clean and trim excess glazing materials from the glass, stops and frames and eliminate stains and discolorations.

3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project 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.

END OF SECTION 088000

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SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
 - 1. Film-backed glass mirrors qualifying as safety glazing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- C. Samples: For each type of the following:
 - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
 - 2. Mirror Trim: 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of mirror and mirror mastic.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Avalon Glass and Mirror Company.
 - 2. Guardian Industries Corp.
 - 3. Walker Glass Co., Ltd.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Annealed Monolithic Glass Mirrors: Mirror Select Quality, clear.
 - 1. Nominal Thickness: 6.0 mm.
- C. Safety Glazing Products: For film-backed mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Laurence, C. R. Co., Inc.; CRL Standard "J" Channel.
 - 2) Sommer & Maca Industries, Inc.; Heavy Gauge Aluminum Shallow Nose "J" Moulding Lower Bar.
 - 2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.05 inch.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Laurence, C. R. Co., Inc.; CRL Deep "J" Channel.
 - 2) Sommer & Maca Industries, Inc.; Heavy Gauge Aluminum Deep Nose "J" Moulding Lower Bar.

3. Finish: Clear bright anodized.

- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Flat polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

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1. Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed, extruded-aluminum louvers.

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples: For each type of metal finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Windborne-debris-impact-resistance test reports.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Design earthquake spectral response acceleration, short period (Sds) for Project is indicated on the drawings.
 - 2. Component Importance Factor: 1.0.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Wind-Driven-Rain-Resistant Louver:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Airolite Company, LLC (the); SCH601 with fully recessed mullions or comparable product by one of the following:
 - a. Greenheck Fan Corporation.
 - b. Nystrom, Inc.
 - c. Ruskin Company; Tomkins PLC.
 - 2. Louver Depth: 6 inches.
 - 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
 - 4. Louver Performance Ratings:
 - a. Free Area: Not less than 7.5 sq. ft. for 48-inch- wide by 48-inch- high louver.
 - b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a core-area intake velocity of 650 fpm.
 - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 - 6. Head and Sill Flashing: Minimum 0.060 inch aluminum, color to match louver finish.

2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening except where insect screening is indicated.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type: Rewirable frames with a driven spline or insert.
- D. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inchwire.
 - 2. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inchwire.

2.5 BLANK-OFF PANELS

- A. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
 - 1. Thickness: 1 inch.
 - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 - 3. Insulating Core: Rigid, glass-fiber-board insulation.
 - 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inchnominal thickness, with corners mitered and with same finish as panels.
 - 5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 - 6. Panel Finish: Same finish applied to louvers.

2.6 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.7 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 - 2. Exterior Corners: Prefabricated corner units with mitered blades with concealed close-fitting splices and with fully recessed mullions at corners.
- G. Provide subsills made of same material as louvers or extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.8 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: Custom color to match hollow metal doors on same side of building these louvers are located.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, 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 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

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SECTION 090500 - FLOOR PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing of concrete floors.
2. Surface preparation of concrete floor to receive the following floor coverings.
 - a. Resilient Tile Flooring.
 - b. Resilient Sheet Flooring.
 - c. Carpet.
 - d. Wood Flooring.
 - e. Resinous Flooring.
3. Accessory products for use on concrete floors which received moisture mitigating admixture.

1.2 SUBMITTALS

- A. Provide Data: Submit complete printed data on all products; preparation and installation procedures.
- B. LEED Submittals LEED - NC Version 2.2:
 1. Credit EQ4.1 or EQ4.2 as applicable: Submit product data for each product stating the VOC content.
- C. Warranty: Submit three (3) fully executed originals of specified warranty.

1.3 QUALITY ASSURANCE

- A. Installer: Regularly engaged in floor preparation procedures specified and acceptance to the product manufacturer.
- B. Product Manufacturer: Provide all products produced by one manufacturer.

1.4 PRODUCT DELIVERY, STORAGE, HANDLING

- A. Deliver products to the site in original unopened, undamaged containers bearing labels as to content, handling, storage, last use dates and application only when necessary for use.
- B. Handle and store in exact accordance with manufacturer's instructions.

1.5 SPECIAL WARRANTY

- A. Special warranties are in addition to and not an abridgement of any warranty available by law.
- B. Provide a special warranty stating the installed system will maintain the moisture vapor transmission rate below 3 lbs./1,000 sq. ft./24 hours for a period of ten (10) years from date of Substantial Completion.
- C. Include cost for removing and replacing finished floor systems, including materials and labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/MATERIALS

- A. If the moisture mitigating admixture specified in Section 033000 - Cast-In-Place Concrete fails testing indicated, then the Contractor must use a system approved by that manufacturer for treatment of the concrete slab and acceptable to the flooring manufacturer.

2.2 ENVIRONMENTAL DESIGN

- A. Provide materials that the VOC limits as referenced in Section 018113.

2.3 MIXING

- A. Mix ingredients of each product in exact accordance with manufacturer's instructions.
- B. Mix only the quantity that can be used immediately.

PART 3 - EXECUTION

3.1 INSPECTION/TESTING

- A. Before testing the concrete substrate for moisture, verify that the concrete is in its final conditioned environment at 73°F (23°C) and 50% relative humidity.
- 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 manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests as follows.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation on substrates with maximum moisture-vapor-emission rate in excess of 3 lbs. of water/1,000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170.
- C. Verify Substrate is free of bond-inhibiting materials and is suitable concrete substrate by performing a Direct Tensile Bond Test (ASTM D4541) with a minimum 175 psi (1,21 MPa) as per ACI (American Concrete Institute) recommendations.

3.2 SURFACE PREPARATION

- A. Thoroughly clean surface of any substance that could interfere with the bond includes dirt, paint, tar, asphalt, silicates, wax, oil, grease, latex compounds, sealers, curing compounds, form release agents, laitance, loose topping, foreign substances and adhesives residue.
- B. Mechanically prepare cracks and control, construction, saw cuts and expansion joints with a diamond crack-chasing/concrete-cutting blade. Overcut the joint width to obtain a sound substrate. Use a dustless collection system to completely remove dust and contaminants.
- C. Mechanically clean and prepare the concrete substrate by shotblasting, scarifying, sandblasting, aggressive diamond-cup grinding, aggressive terrazzo diamond-plug grinding or other engineer-approved methods to obtain ICRI (International Concrete Repair Institute) CSP (Concrete Surface Profile) #2 (diamond-cup ground) or #3 (shotblasted).
- D. Vacuum the prepared cracks and joints again to remove all dust, steel shot and contaminants.
- E. Concrete substrates and ambient room temperatures must be a minimum 60°F (16°C) with a maximum 86°F (30°C). Temperatures must be maintained within this range for a minimum of 24 hours after installation of the finish flooring system.

3.3 APPLICATION – MOISTURE REDUCTION BARRIER

- A. Apply in strict accordance with manufacturer's written instructions.
- B. Use a short-nap (3/8" (10 mm)) roller. Start rolling material in a north/south direction, followed immediately in an east/west direction across the entire surface being treated up to and around perimeter of any restrained surfaces (such as walls and columns). Apply only one coat with sufficient material working it into the concrete substrate. Use a quality paintbrush for the hard-to-reach areas.
Note: Do not spray material onto the surface. Material must be worked into the pores of the prepared concrete substrate, cracks, and joints; coat the sidewalls and bottom of the cavity using a roller or brush.
- C. Cover the concrete substrate completely without any voids or pinholes fill saw-cut joints and cracks. Install at a rate as directed by the product manufacture to achieve proper moisture levels.
- D. Allow to thoroughly dry.

3.4 APPLICATION OF LEVELING COMPOUND

- A. Immediately after mixing, apply in exact accordance with manufacturer's instructions.
- B. Apply using a flat edge steel trowel finishing to smooth level surface free of trowel marks.

3.5 PROTECTION

- A. Close area to traffic and ventilation until thoroughly dry.

END OF SECTION 090500

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SECTION 092116 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gypsum board shaft-wall assemblies for the following:

1. Shaft-wall enclosures.
2. Chase enclosures.
3. Stair enclosures.
4. Horizontal enclosures.

1.2 SUBMITTALS

- A. Product Data: For each gypsum board shaft-wall assembly indicated.
- B. LEED Submittals:
1. Product Data - Adhesives and Sealant: For adhesives and sealants, including printed statement of VOC content.
 2. Product Data - Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 3. Include statement indicating costs for each product having recycled content.
- C. Certifications: Provide Manufacturer Certification specified in "Steel Framing for Framed Assemblies" article in Part 2 below.

1.3 QUALITY ASSURANCE

- A. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures for installing gypsum board shaft-wall assemblies including, but not limited to, the following:
1. Fasteners proposed for anchoring nonstructural steel framing to building structure.
 2. Sprayed fire-resistive materials applied to structural steel framing.
 3. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.
 4. Wiring devices in shaft-wall assemblies.
 5. Doors and other items penetrating shaft-wall assemblies.
 6. Items supported by shaft-wall-assembly framing.
 7. Mechanical work enclosed within shaft-wall assemblies.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
- C. Stack panels flat on leveled supports off floor or slab to prevent sagging.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corporation.
 - 2. G-P Gypsum.
 - 3. National Gypsum Company.
 - 4. USG Corporation.

2.2 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

- A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
 - 1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
 - 2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.
- B. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.

2.3 PANEL PRODUCTS

- A. Gypsum Liner Panels: Comply with ASTM C 1396/ASTM C 1396M.
 - 1. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.
 - a. Core: 1 inch thick.
 - b. Long Edges: Double bevel.
- B. Gypsum Board: As specified in Division 09 Section "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

- A. Framing Members: Comply with ASTM C 754 for conditions indicated.
 - 1. Design Values:
 - a. Deflection Limit:
 - 1) L/240 unless otherwise noted.
 - 2) L/360 where Level 5 gypsum board finish is indicated, at tile backing panels, where plaster veneer is indicated, and elsewhere as noted.
 - b. Lateral Pressure:
 - 1) 5.0 psf (240 Pa) unless otherwise noted.
 - 2) 7.5 psf (360 Pa) at all shaft enclosures penetrating one or more floors, elevator enclosures, pressurized plenums, entrance lobbies and vestibules with automatic entrances, and elsewhere as noted.

3) 10 psf (480 Pa) at stair enclosures.

- B. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 1. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
 - 2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized, unless otherwise indicated.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section "Gypsum Board" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.
- C. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board."
- D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- E. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- F. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- G. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 35 percent by weight.
- H. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
 - 1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated.
- B. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - 1. Depth: As indicated.
 - 2. Minimum Base-Metal Thickness: 0.0329 inch.
 - 3. Type of Studs: Use one of the following types:
 - a. Plain steel studs.
 - b. Embossed steel studs.

4. Manufacturer Certification: If embossed steel studs are used, submit written certification from stud manufacturer stating that the proposed stud meets or exceeds the span limitations indicated in ASTM C 754 with signature and seal of a structural engineer licensed in the state where the project is located.
- C. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches long and in depth matching studs.
 1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Type of Runner Track: Use one of the following types:
 - a. Plain steel runner tracks.
 - b. Embossed steel runner tracks.
 3. Manufacturer Certification: If embossed steel runner tracks are used, submit written certification from runner track manufacturer stating that the proposed runner track meets or exceeds the span limitations indicated in ASTM C 754 with signature and seal of a structural engineer licensed in the state where the project is located.
- 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.
- E. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0329 inch thick.
- F. Room-Side Finish: As indicated on Drawings.
- G. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.
- H. Insulation: Sound attenuation blankets.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 07 Section "Applied Fireproofing."
 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runner tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft-wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
 - 1. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
 - 2. Division 09 Section "Gypsum Board" for applying and finishing panels.
- B. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
 - 1. At elevator hoistway entrance door frames, provide jamb struts on each side of door frame.
 - 2. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 gypsum board face-layer panel.
- D. Integrate stair hanger rods with gypsum board shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.
- E. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- F. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- G. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- H. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.
- I. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.
- J. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 4 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- thick, gypsum board cants covering tops of projections. No recesses allowed (at steel beams especially).
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft-wall framing.
 - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft-wall framing.
- K. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 PROTECTION

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- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
 - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
 - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittal:
 - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - 2. Include statement indicating costs for each product having recycled content.

PART 2 - PRODUCTS

2.1 DESCRIPTION

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- D. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Design Values:
 - a. Deflection Limit:
 - 1) L/240 unless otherwise noted.
 - 2) L/360 where Level 5 gypsum board finish is indicated, at tile backing panels, where plaster veneer is indicated, and elsewhere as indicated.
 - b. Lateral Pressure:
 - 1) 5.0 psf (240 Pa) unless otherwise noted.
 - 2) 7.5 psf (360 Pa) at all shaft enclosures penetrating one or more floors, elevator enclosures, pressurized plenums, entrance lobbies and vestibules with automatic entrances, and elsewhere as noted.
 - 3) 10 psf (480 Pa) at stair enclosures.
 - 2. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 3. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 2-1/2 inches.
- E. Furring Channels (Furring Members):
 - 1. Steel Studs: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0312 inch.
 - b. Depth: 2-1/2 inches.
 - 2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base Metal Thickness: 0.0312 inch.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640-C or 660-C Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
 - 2. Depth: As indicated on Drawings.
 - 3. Type of Studs and Runners:
 - a. Plain steel studs and runners.
 - b. Embossed steel studs and runner.
 - 4. Manufacturer Certification: If embossed steel studs and runners are used, submit written certification from stud and runner manufacturer stating that the proposed stud meets or exceeds the span limitations indicated in ASTM C 754 with signature and seal of a structural engineer licensed in the state where the project is located.
- B. Slip-Type Head Joints: Where indicated, provide the following:
 - 1. Deflection Track or Angle System: Steel sheet top runner or slotted angle system 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.

- C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Metal Back-up Plates: Minimum thickness of 0.0538 inch galvanized steel plates of sizes and configurations detailed, or if not detailed, as required to accommodate the wall hung casework, millwork, railings or other items mounted to metal stud and wallboard walls and partitions.
 - 1. Provide plates designed, and certified, to support an imposed load of 250 lbs. per linear foot for handrails, grab bars and other ADA-compliant items. Provide plates designed, and certified, to support an imposed load of 144 lbs. per linear foot for all other items. All loads required above are in addition to the weight of the item supported by the back-up plate.
 - 2. Provide plates designed for screw-attachment to steel studs with back-up plate faces flush with face of studs or overlapping face of studs with pre-cut notches matching stud spacing.
- E. Television/Monitor Mounting Plates: Minimum 1/4-inch thick steel plates fabricated in sizes and configuration detailed to accommodate wall hung television/monitor brackets. Locate where indicated on Drawings. If plates are not indicated on Drawings, provide in locations selected by Owner.
 - 1. Verify load and attachment requirements and fabricate accordingly.
- F. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches, unless otherwise indicated.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base Metal Thickness: 0.0312 inch.
 - 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 3/4 inch, unless otherwise indicated.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.
- J. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

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.

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.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
 - 1. Comply with details indicated. Install metal back-up plates in accordance with plate manufacturer's written instructions using self-tapping pan-head screws of type and in quantity required by manufacturer to achieve full load capacity.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- 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. Do not attach hangers to steel roof deck.
- 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
 - 1. Space studs as follows:
 - a. Single-Layer Application: 16 inches o.c., unless otherwise indicated.
 - b. Multi-Layer Application: 16 inches o.c., unless otherwise indicated.
 - c. Tile Backing Panels: 16 inches o.c., unless otherwise indicated.
- C. 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 penetrating 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. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch 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: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- D. Direct Furring:
1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- E. Z-Furring Members:
1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092713 - GLASS-FIBER-REINFORCED PLASTER FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes factory-fabricated, glass-fiber-reinforced plaster fabrications for interior applications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, weights, dimensions of individual components and profiles, and finishes.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and assembly of glass-fiber-reinforced plaster fabrications.
 - 3. Indicate requirements for joint treatment.
 - 4. Indicate location of control joints.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with one another, using input from installers of the items involved:
 - 1. Ceiling suspension system members.
 - 2. Structural members to which glass-fiber-reinforced plaster fabrications will be attached and method of attachment.
 - 3. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C 1467/C 1467M.

1.5 FIELD CONDITIONS

- A. Environmental Conditions:
 - 1. Comply with ASTM C 1467/C 1467M.
 - 2. Do not deliver or install glass-fiber-reinforced plaster fabrications until building is enclosed, wet-work is complete, and HVAC system is operating and continuously maintaining temperature and relative humidity at levels intended for building occupants.

- B. Conditioning: Acclimatize glass-fiber-reinforced plaster fabrications to ambient temperature and humidity of spaces in which they will be installed. Remove packaging and move units into installation spaces not less than 48 hours before installing them.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED PLASTER FABRICATIONS

- A. Fabrications: Molded, glass-fiber-reinforced plaster units complying with ASTM C 1381/C 1381M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Casting Designs, Inc.
 - b. Decoform
 - c. Formglas Inc.
 - d. Melton Classics, Incorporated.
 - e. Stromberg Architectural Products, Inc.
- B. Embedments: As standard with glass-fiber-reinforced plaster fabrication manufacturer and as required for reinforcement and for anchorage to substrates and framing.
- C. Finish: Smooth for paint finish.

2.2 AUXILIARY MATERIALS

- A. Adhesives: As recommended in glass-fiber-reinforced plaster fabrication manufacturer's written instructions.
 - 1. Adhesive: As recommended by glass-fiber-reinforced plaster fabrication manufacturer and with a VOC content of 50 g/L or less.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Screws complying with ASTM C 954 for fastening glass-fiber-reinforced plaster fabrications to steel members from 0.033 to 0.112 inch thick.
- C. Joint-Treatment Materials: ASTM C 475/C 475M.

2.3 FABRICATION

- A. Fabricate glass-fiber-reinforced plaster units in factory to comply with ASTM C 1381/C 1381M, with smooth-finished surfaces; repair hollows, voids, scratches, and other surface imperfections. Fabricate units in lengths and sizes that will minimize number of joints between abutting units.
- B. Embedments: Incorporate embedments into units to develop the full strength of glass-fiber-reinforced plaster fabrications. Cover embedments with not less than 3/16-inch thickness of glass-fiber-reinforced plaster composite.
- C. Connection Hardware: Designed and fabricated to support and connect glass-fiber-reinforced plaster fabrications to hangers, support framing, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with ASTM C 1467/C 1467M.
- B. Install glass-fiber-reinforced plaster fabrications level, plumb, true, and aligned with adjacent materials. Use concealed shims where required for alignment.
- C. Attach glass-fiber-reinforced plaster fabrications to framing and substrates with steel drill screws unless otherwise indicated. Do not use pneumatic staple guns. Countersink screw heads below adjoining finished surface.
 - 1. Predrill fastener holes in units. Clean fastener holes to remove dirt and oil.
 - 2. Locate fasteners not less than 5/16 inch from edges or ends of units.
- D. Where glass-fiber-reinforced plaster fabrications are joined to form composite units, join fabrications with adhesive. Band or brace units together until adhesive cures.
- E. Use joint-treatment materials to finish glass-fiber-reinforced plaster fabrications to produce surfaces ready to receive primers and paint finishes specified in Section 099123 "Interior Painting."
 - 1. Finish glass-fiber-reinforced plaster fabrications according to ASTM C 840 for Level 4 and to match surface texture of units.
 - 2. Repair hollows, voids, scratches, and other surface imperfections on units.

END OF SECTION 092713

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawing: Indicate location of all control joints on floor plans and on reflected ceiling plans for Architect review and comment.
- C. Samples: For the following products:
1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
- D. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Product Data: For adhesives and sealants, indicating VOC content.
- E. Certification Letter: Submit letter on Contractor's letter head stationary signed by Contractor indicating that all materials incorporated into this Project comply with requirements specified in this Specification or are accepted equivalent products.

1.3 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
 - 1. Marking Fire-Resistance-Rated Assemblies: Apply hourly rating text in 4-inch high red numbers and black Arial font letters at maximum 10 feet between rating text applications as measured from beginning of one text application to end of next text application extending from one end of fire-resistance-rated wall to opposite end of fire-resistance-rated wall, located 6 inches above finished ceiling to bottom of text. Provide following hourly rating text as applicable to wall:
 - a. 1 HR
 - b. 2 HR
 - c. 3 HR
 - d. 4 HR
 - e. 1 HR Fire/Smoke
 - f. 2 HR Fire/Smoke
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 PANELS, GENERAL

- A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 GYPSUM BOARD

- A. Regional Materials: Products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; ProRoc Type X.
 - b. Georgia-Pacific Building Products; ToughRock Fireguard Gypsum Board
 - c. National Gypsum Company; Gold Bond Brand Fire-Shield Wallboard.
 - d. United States Gypsum Company; USG Imperial® Gypsum Base, Firecode® X.
 - 2. Thickness: 5/8 inch.
 - 3. Long Edges: Tapered.
- B. Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Gypsum; DensArmor Plus Impact-Resistant Panel.
 - b. National Gypsum Company; Hi-Impact Brand XP Fire-Shield Wallboard.
 - c. United States Gypsum Company; USG Sheetrock® Brand Mold Tough® VHI (Very High Impact) Firecode® Core.
 - 2. Core: 5/8 inch, Type X.

3. Surface Abrasion: Meets or exceeds Level 3 requirements.
4. Surface Indentation: Meets or exceeds Level 1 requirements.
5. Single-Drop Soft-Body Impact: Meets or exceeds Level 3 requirements.
6. Hard-Body Impact: Meets or exceeds Level 3 requirements according to test in Annex A1.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; FiberCement BackerBoard.
 - b. National Gypsum Company; PermaBase BRAND Cement Board.
 - c. United States Gypsum Company; DUROCK Cement Board.
 2. Thickness: As indicated on Drawings if not indicated, 5/8 inch .
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Basis-of-Design Material: Plastic by Trim-Tex Drywall Products unless specifically noted otherwise on the drawings.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Corner Guard: Where corner guards are indicated, use Certainteed NO-COAT Structural Laminate Drywall Corner System.
1. Product: ULTRATRIM OUTSIDE 90.
- C. Extruded Aluminum Trim and Reveals: Use products indicated on the drawings or Architect approved equivalents.

2.7 JOINT TREATMENT AND FINISH MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: 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 drying-type, all-purpose compound.

- a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
- 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. 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 thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. 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. Thickness: Minimum of 3 inches or as indicated for partition type.
 - 2. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
- E. Thermal Insulation: As specified in Division 07 Section "Building Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- 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/soffit 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 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. 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- wide joints to install sealant.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- 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.
- I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 - 1. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- K. Fire-Resistance-Rated Assemblies: Provide marking of fire-resistance-rated assemblies as specified in Performance Requirements article in Part 2 of this Section.
- L. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c., unless otherwise recommended by manufacturer or referenced standards.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces, unless otherwise indicated.
 - 2. Impact-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Offset seams a minimum of 16 inches, but directly over framing. In no instances shall seams of gypsum board be installed directly above another.
5. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. STC Rated Partitions:

1. Maintain a 1/4 inch gap between the gypsum board / floor and gypsum board / ceiling. This gap to be filled with acoustical sealant.
2. Joints or seams greater than 1/8 inch in walls shall be caulked with acoustical sealant.
3. In multilayer applications, each layer shall be sealed according to above prior to installation of next layer.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
- C. 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 at locations indicated on Drawings and as follows:

1. Install where a partition, wall, or ceiling traverses a construction joint (expansion, seismic or building control element) in the base building structure.
2. Install where movement may occur at joints in a wall or partition supported by building systems that move differentially.
3. Install where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear ft .
 - a. Install control joint on each side of door jamb (two total).
4. Install in interior ceilings with perimeter relief so that linear dimensions between control joints do not exceed 50 ft and total area between control joints does not exceed 2500 sq ft .
5. Install in interior ceilings without perimeter relief so that linear dimensions between control joints do not exceed 30 ft and total area between control joints does not exceed 900 sq ft .
6. Install in exterior ceilings and soffits so that linear dimensions between control joints do not exceed 30 ft and total area between control joints does not exceed 900 sq ft .
7. Install where ceiling framing members change direction.
8. Install at one side of door frames. Full height door frames shall be considered equivalent to a control joint.
9. Install all control joints at specific locations approved by the Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.
5. Curved-Edge Cornerbead: Use at curved openings.

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 those with trim having flanges not intended for 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 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.
 4. Level 5: For surfaces to receive gloss finish, dry erase coatings and where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.
 1. Apply Level 5 finish (ASTM C 840) to backer surfaces receiving painted finish

3.7 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
 - 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
 - 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air-duct systems.
 - d. Installation of air devices.
 - e. Installation of mechanical system control-air tubing.
 - f. Installation of ceiling support framing.

3.8 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.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Porcelain tile.
 - 2. Crack isolation membrane.

1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
 - 1. Crack isolation membrane.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics 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.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.3 TILE PRODUCTS

- A. Ceramic Tile Type : porcelain tile.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings .
 - 2. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cap: Surface bullnose, module size same as adjoining flat tile.

2.4 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
- b. Laticrete International, Inc; Laticrete Blue 92 Anti-Fracture Membrane.
- c. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh.

2.5 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. ARDEX GmbH.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
3. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
4. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.

B. Medium-Bed, Modified Dry-Set Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX GmbH.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. 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. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.

2.6 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.

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.
 - d. TEC, H. B. Fuller Construction Products Inc.

B. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.7 MISCELLANEOUS MATERIALS

- ### **A. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; nickel silver exposed-edge material.**

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Schluter Systems L.P.
- B. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 1. Products: Subject to compliance with requirements, provide the following:
 - a. Custom Building Products; Grout and Tile Sealer.

2.8 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 mediumset or 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 mediumset or 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 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.

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 the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors consisting of tiles 8 by 8 inches or larger.
 - b. Tile floors consisting of rib-backed tiles.
- 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. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. 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 the following joint widths:
 - 1. Porcelain Tile: 1/8 inch.
- 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. Floor Sealer: Apply floor sealer to[cementitious] grout joints[in tile floors] according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure 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 F125-Full; mediumset mortar on crack isolation membrane.
 - a. Mediumset Mortar: Modified dry-set mortar.
 - b. Grout: Standard sanded cement grout.
- B. Interior Wall Installations, Wood or Metal Studs or Furring:
 - 1. Ceramic Tile Installation : TCNA W243; thinset mortar on gypsum board.
 - a. Thinset Mortar: Standard dry-set mortar.
 - b. Grout: Sand-portland cement grout.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.
- C. Related Sections:
 - 1. 095426 – Linear Wood Ceilings

1.2 DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
 - 2. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.
- C. Qualification Data: For testing agency.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- E. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.
- F. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 - 2. Suspension System: Obtain each type through one source from a single manufacturer.

- C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
 - 1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Smoke-Developed Index: 450 or less.
- E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
 - 2. Cisca's Recommendations for Acoustical Ceilings: Comply with Cisca's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - 3. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages 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.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, 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.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Recycled Content: Provide acoustical panels with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 10 percent by weight.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.
- B. Color: White.
- C. Modular Size and Thickness: As indicated on Drawings.
- D. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.
- E. NRC Rating: Basis-of-Design is the minimum acceptable NRC.
- F. Fire Class: Minimum Class A.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

- D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 - c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
- I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
- B. 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 according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.
 - 1. Structural Classification: Heavy-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel or aluminum cold-rolled sheet.
 - 5. Cap Finish: Painted in color as selected from manufacturer's full range .
- C. Narrow-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 according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 9/16-inch- wide metal caps on flanges.
 - 1. Structural Classification: Heavy-duty system.
 - 2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Steel or aluminum cold-rolled sheet.

5. Cap Finish: Painted in color as selected from manufacturer's full range.

2.5 METAL EDGE MOLDINGS AND TRIM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
 1. Aluminum Alloy: 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 aluminum extrusions complying with ASTM B 221 (ASTM B 221M) for Alloy and Temper 6063-T5.
 2. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
 3. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - a. Organic Coating: Thermosetting, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils.

2.6 SOUND CONTROL MATERIAL

- A. Sound Control Tile: Quiet Tile CAC 51 by Kinetics Noise Control for application to back of ceiling tiles. Tiles to be sent to Kinetics for application to the back of the tile.
- B. Ceiling Grid: Heavy duty grid to support ceiling tile of 2.2 psf sound control tile and comply with seismic requirements.
- C. Ceiling Grid Isolators: AF Hangers by Kinetics Noise Control to isolate ceiling grid from structure.

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.
 1. 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, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. Non-Fire-Resistance-Rated Indirect Hung Suspension System:
 1. Structural Classification: Heavy-Duty System.

- B. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- C. 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 either to structures 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. 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.
 - 6. 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.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- D. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. 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 a neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to [long] [short] axis of space.
 - c. Install panels in a basket-weave pattern.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. 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.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:
 1. Suspended ceiling system.
 2. Hangers, anchors and fasteners.
- B. Tests and Inspections: Testing and inspecting of completed installations of acoustical panel ceiling hangers and anchors and fasteners shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
 1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - a. Within each test area, testing agency will select 1 of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every 2 postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
 - b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- C. Remove and replace acoustical panel ceiling hangers and anchors and fasteners that do not pass tests and inspections and retest as specified above.

3.5 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. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 095426 - LINEAR WOOD CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Concealed suspension system for wood grille ceiling panels.
 - 2. Wood grille ceiling panels for concealed suspension system.
 - 3. Wood grille vertical installations with concealed suspension system.
 - 4. Trim and accessories.
 - 5. Seismic restraints for suspended ceiling system.
- B. Related Sections include the following:
 - 1. Division 09 Section "Acoustical Panel Ceilings" for type of tile to place over finished wood grille for acoustic absorption.

1.2 REFERENCES

- A. ASTM A 641: Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire; 1992.
- B. ASTM C 423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 1990.
- C. ASTM C 635: Standard Specifications for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
- D. ASTM C 636: Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 1992.
- E. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials; 1991.
- F. ASTM E 580: Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint; 1991.
- G. AWI: Architectural Woodwork Quality Standards Illustrated; 2003.
- H. CISCA: Ceiling Systems Handbook.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Provide Shop Drawings/Coordination Drawings for all ceilings, which should include RCP and product details.
 - 2. Coordinate wood grille ceiling panels layout and installation of wood panels and suspension system components with other construction elements that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components, partition assemblies and all perimeter conditions.
- C. Samples: For verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the range of variations expected.
 - 1. 12 inch by 18 inch samples of each panel type, pattern, and color.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
 - 1. Wood grille ceiling panels: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
 - 2. Suspension System Components: Furnish quantity of each component equal to 2.0 percent of amount installed.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer, approved by wood ceiling manufacturer, who has completed panel ceilings similar in species, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Inspection: All work must pass approval of architect, as well as the local codes and regulations or authorities having jurisdiction.
- C. Single-Source Responsibility for Wood Ceiling System: Obtain each type of wood grille ceiling panels from a single fabricator, with in-house Shop Drawing capabilities, in-house assembly and finishing capabilities, and with resources to provide products of consistent quality in appearance and physical properties without delaying the project.
- D. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying project.
- E. Pre-Installation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery & Unloading: Coordinate crate sizes, weights, unloading options, and delivery schedule with manufacturer prior to fabrication. Deliver wood panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other mistreatment.
- B. Acclimatization: Before installing wood panels, permit them to reach room temperature and a stabilized moisture content (at least 72 hours) per AWI standards.
- C. Handling: Handle wood grille ceiling panels carefully to avoid chipping edges or damaging units in any way.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide 9Wood, Inc.; 1400 Hybrid Grille

2.2 MATERIALS

- A. Wood Panels:
 - 1. Species: Quarter sawn, white oak.
 - 2. Size: As indicated on the drawings.
 - 3. Spacing: As indicated on the drawings.
 - 4. Edge Profile: Square.
 - 5. Assembly Style: Cross piece backer and dowel.
 - 6. Panel Size, As indicated on the drawings.

7. Class 1 (A) fire rating.
 8. Finish: Clear satin.
 9. Backers painted white.
- B. Metal ceiling suspension System:
1. Metal T-Grid Suspension System: Provide standard interior metal heavy duty 15/16 inch suspension T-Grid system using Main Runners, Cross-tees, Wall Angle or Shadow Moldings of types, structural classifications, and white finishes indicated and that comply with applicable ASTM C 635 requirements. Comply with all applicable seismic codes and ordinances for seismic design category indicated.
 2. Attachment Devices: Size for 3 times the design load indicated in ASTM C 635, Table 1, direct hung to structure unless otherwise indicated.
 3. Wire, Braces, Ties, Hanger Rods, Flat Hangers and Angle Hangers: Provide wires, rods and hangers that comply with applicable ASTM specifications.
- C. Metal wall suspension system: Extruded aluminum tube framing support, ASTM B221, concealed fastening top & bottom.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which ceilings attach or abut, with installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish the layout of Wood Grille Panel to balance border widths at opposite edges of each ceiling.
- B. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans in accordance with wood ceiling manufacturer's approved Shop Drawings.

3.3 INSTALLATION

- A. Install to comply with manufacturer's written instructions and CISCA "Ceiling Systems Handbook."
- B. Attachments: Suspend ceiling hangers from building's structural members per manufacturer's instructions and in compliance with all local codes and regulations.
- C. Installation of Metal T-Bar Grid: Install, align, brace, tie-off, mount, handle interferences, and space suspension T-Grid in accordance with suspension manufacturer's instructions and in compliance with all local codes and regulations.
- D. Install wood grille ceiling panels in accordance with manufacturer's installation instructions and in compliance with all local codes and regulations. Install with undamaged edges and fitted accurately to suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit, as required.
- E. Install suspension system runners so they are square and securely interlocked with one another. Install number and use on-center spacing per wood ceiling manufacturer's instructions, as indicated on approved Shop Drawings and in compliance with all local codes.
- F. Place acoustical ceiling panel on top of installed wood grille once installed.

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3.4 ADJUSTING AND CLEANING

- A. Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace wood ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- B. Remove and replace warped, bowed, or otherwise damaged grilles.

END OF SECTION 095426

SECTION 096229 - CORK FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cork floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit MR 6: For cork flooring, documentation including printed statement of cost for each rapidly renewable material.
2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
3. Product Data for Credit IEQ 4.3: For adhesives, sealer and finish coatings, documentation including printed statement of VOC content.
4. Product Data for Credit IEQ 4.3: For cork flooring, documentation from an independent testing agency indicating compliance with the FloorScore standard.
5. Product Data for Credit IEQ 4.4: For cork flooring products, documentation indicating that the bonding agents and adhesives contain no urea formaldehyde.

C. Shop Drawings: For each type of cork flooring. Include cork flooring layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

D. Samples for Verification: Full-size units of each type, color, pattern, and finish of cork flooring required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of cork flooring to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cork Flooring: Furnish one box for every 50 boxes or fraction thereof, of each type, color, pattern, and finish of cork flooring installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cork flooring 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 or more than 90 deg F. Store cork flooring on flat surfaces.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 75 deg F where relative humidity is between 45 and 55 percent, in spaces to receive cork flooring during the following time periods:

1. 72 hours before installation.

2. During installation.
 3. 72 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 75 deg F.
 - C. Close spaces to traffic during cork flooring installation.
 - D. Close spaces to traffic for 72 hours after cork flooring installation.
 - E. Install cork flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Flooring shall comply with requirements of FloorScore certification.

2.2 CORK FLOOR TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
- B. Composition: 100 percent natural cork bark and recycled cork granules and set in a natural or synthetic, flexible resin matrix; homogeneous and uniform in composition throughout the tile thickness.
- C. Nominal Density: 35 lb/cu. ft., minimum.
- D. Nominal Thickness: 0.188 inch.
- E. Nominal Size: 24 by 24 inches.
- F. Color: As indicated by manufacturer's designations.
- G. Factory Finish: Polyurethane.

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 cork flooring manufacturer for applications indicated.
- B. Adhesive: Water-resistant products as recommended by flooring and adhesive manufacturers to suit cork flooring and substrate conditions indicated.
 1. Adhesives shall have a VOC content of 50 g/L or less.

2.4 FIELD-APPLIED FINISHES

- A. Sealer: Product as recommended by cork flooring manufacturer.
 1. Sealers shall have a VOC content of 350 g/L or less.

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 cork flooring.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to cork flooring manufacturer's written instructions to ensure adhesion of cork flooring.
- 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 cork flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by cork flooring 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 9 pH.
 - 4. Moisture Testing: Perform tests recommended by cork flooring manufacturer, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- 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 cork flooring until materials are same temperature as space where they are to be installed.
 - 1. At least 72 hours in advance of installation, move cork flooring products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by cork flooring.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing cork flooring.
- B. Mix together floor tiles from each carton to ensure uniform distribution of shade.
- C. Discard broken, cracked, chipped, or deformed floor tiles.
- D. 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.
- E. Lay floor tiles in pattern indicated.
- F. 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.
- G. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- H. 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.

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- I. Adhere flooring 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 FIELD-APPLIED FINISHES

- A. Apply finishes according to cork flooring manufacturer's written instructions.
- B. Cork Sealer: Apply two coat(s).

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting cork flooring.
- B. Perform the following operations immediately after completing cork flooring installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect cork flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover cork flooring until Substantial Completion.

END OF SECTION 096229

SECTION 096400 - WOOD FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Field-finished wood flooring.
2. Sound control underlayment.

1.2 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Certificates for : Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
2. Product Data for Credit IEQ 4.1: For wood flooring installation adhesives, documentation including printed statement of VOC content.
3. Product Data for Credit IEQ 4.2: For field-applied finishes for wood flooring, documentation including printed statement of VOC content.
4. Product Data for Credit IEQ 4.3: For wood flooring installation adhesives and field-applied finishes for wood flooring, documentation including printed statement of VOC content.
5. Product Data for Credit IEQ 4.3: For wood flooring, documentation from an independent testing agency indicating compliance with the FloorScore Standard.
6. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that the bonding agent contains no urea formaldehyde.

C. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include expansion provisions and trim details.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes available for wood flooring.

E. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.

1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood flooring materials in unopened cartons or bundles.

B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.5 PROJECT CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
 - 1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Wood floors shall comply with requirements of FloorScore Standard.

2.2 FIELD-FINISHED WOOD FLOORING

- A. Certified Wood: Provide wood flooring produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- B. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled.
 - 1. Species and Grade: MFMA-RL First Grade hard maple.
 - 2. Cut: Quarter/rift sawn.
 - 3. Thickness: 3/4 inch.
 - 4. Face Width: 2-1/4 inches.
 - 5. Lengths: Random-length strips complying with applicable grading rules.
- C. Urethane Finish System: Complete water-based system of compatible components that is recommended by finish manufacturer for application indicated.
 - 1. VOC Content: When calculated according to 40 CFR 59, Subpart D (EPA Method 24), as follows:
 - a. Finish Coats and Floor Sealers: Not more than 350 g/L.
 - b. Stains: Not more than 250 g/L.
 - 2. Stain: Penetrating and nonfading type.
 - a. Color: As selected by Architect from manufacturer's full range.
 - 3. Floor Sealer: Pliable, penetrating type.
 - 4. Finish Coats: Formulated for multicoat application on wood flooring.
- D. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.3 SOUND CONTROL UNDERLAYMENT

- A. Sound Control Underlayment: Sound reducing underlayment consisting of impact-absorbing

materials. Minimum Impact Insulation Class (IIC) of 55 when tested according to ASTM E 492.

1. Material: Wood fiber that complies 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."
2. Thickness: [3/4 inch] [1/2 inch] [3/8 inch] [1/4 inch] [5/32 inch] <Insert dimension>.

2.4 ACCESSORY MATERIALS

- A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than [6.0 mils] [8.0 mils] thick.
- B. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by wood flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
 - 1) Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

- A. Concrete Slabs: Grind high spots and fill low spots to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
- B. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.

- C. Vapor Retarder: Comply with NOFMA's "Installing Hardwood Flooring" for vapor retarder installation and the following:
 - 1. Wood Flooring Installed Directly on Concrete: Install a layer of polyethylene sheet according to flooring manufacturer's written instructions.

3.4 FIELD FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
 - 1. Comply with applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
- B. Fill and repair wood flooring seams and defects.
- C. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and [three] <Insert number> finish coats.
 - 1. Apply stains to achieve an even color distribution matching approved Samples.
 - 2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
- D. Cover wood flooring before finishing.
- E. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

3.5 PROTECTION

- A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 - 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096400

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient stair accessories.
 - 3. Resilient molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.3: For adhesives, documentation including printed statement of VOC content.
 - 3. Product Data for Credit IEQ 4.3: For resilient stair accessories, documentation from an independent testing agency indicating compliance with the FloorScore standard.
- C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- D. 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 long.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet 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 or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time 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 or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient base and stair accessories shall comply with requirements of FloorScore certification.
- B. Low-Emitting Materials: Flooring system 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."

2.2 THERMOPLASTIC-RUBBER BASE <Insert drawing designation>

- A. Manufacturers: Subject to compliance with requirements, provide products listed in the finish legend.
- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient flooring.
- C. Thickness: 0.125 inch.
- D. Height: As indicated on Drawings.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors: As selected by Architect from full range of industry colors.

2.3 RUBBER STAIR ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products listed in the finish legend.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
- C. Stair Treads: ASTM F 2169.
 - 1. Type: TP (rubber, thermoplastic).
 - 2. Class: 1 (smooth, flat).
 - 3. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
 - 4. Nosing Height: 1-1/2 inches.
 - 5. Thickness: 1/4 inch and tapered to back edge.
 - 6. Size: Lengths and depths to fit each stair tread in one piece.
 - 7. Integral Risers: Smooth, flat; in height that fully covers substrate.
- D. Locations: Provide rubber stair accessories in areas indicated.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products listed in the finish legend.

- B. Description: Rubber transition strips.

2.5 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.
 - 1. Adhesives shall have a VOC content of 50 g/L or less except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

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 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- 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 they are the same temperature as the 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.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 2. Tightly adhere to substrates throughout length of each piece.
 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 1. Remove adhesive and other blemishes from exposed surfaces.
 2. Sweep and vacuum horizontal surfaces thoroughly.
 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

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- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

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SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes rubber sheet flooring.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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.
- C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of resilient sheet flooring required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet flooring 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 or more than 90 deg F . Store rolls upright.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F , in spaces to receive resilient sheet flooring during the following time 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 or more than 95 deg F .
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 UNBACKED RUBBER SHEET FLOORING

- A. Manufacturers: Subject to compliance with requirements, provide products listed in the finish legend.
- B. Product Standard: ASTM F 1859.
 - 1. Type: Type I (homogeneous rubber sheet).
 - 2. Thickness: As standard with manufacturer.
 - 3. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D 2240.
- C. Wearing Surface: Smooth.
- D. Sheet Width: As standard with manufacturer.
- E. Seamless-Installation Method: Heat welded.
- 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 resilient sheet flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: Match flooring.
- D. Integral-Flash-Cove-Base Accessories:
 - 1. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
 - 2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by resilient sheet flooring manufacturer.
 - 3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring 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 resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- 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 resilient sheet flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring 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 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- 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. Floor Marking: Use chalk or chalk lines covered with clear acrylic spray; do not use floor marking paints, markers, or other marking methods that are incompatible with flooring material and allow markings to show through installed flooring material.
 - 1. If substrate has floor marking paints, markers of other marking methods incompatible with flooring and that may allow markings to show through installed flooring material, remove markings using mechanical methods recommended by flooring manufacturer.
 - 2. Do not install flooring until incompatible floor markings on substrate have been removed and substrate is acceptable to flooring manufacturer for installation of flooring materials.
- E. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.
 - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- H. Adhere resilient sheet flooring 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.
- I. Seamless Installation:
 - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
- J. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
 - 1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl floor tile.
 - 2. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, sealants, documentation including printed statement of VOC content.
 - 2. Product Data for Credit IEQ 4.3: For adhesives, documentation including printed statement of VOC content.
 - 3. Product Data for Credit IEQ 4.3: For resilient tile flooring, documentation from an independent testing agency indicating compliance with the FloorScore standard.
- C. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile 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 or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

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- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time 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 or more than 95 deg F.
- 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 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.

2.2 SOLID VINYL FLOOR TILE

- A. Manufacturers: Subject to compliance with requirements, provide products listed in the finish legend.
- B. Tile Standard: ASTM F 1700.
 - 1. Class: As indicated by product designations.
- C. Size: 12 by 24 inches.
- D. Colors and Patterns: As indicated by manufacturer's designations.

2.3 VINYL COMPOSITION FLOOR TILE

- A. Manufacturers: Subject to compliance with requirements, provide products listed in the finish legend
- B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch.
- E. Size: 12 by 12 inches.
- F. Colors and Patterns: As indicated by manufacturer's designations.

2.4 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.

1. Adhesives shall comply with the following limits for VOC content:
 - a. Vinyl Composition Tile Adhesives: 50 g/L or less.
- 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 9 pH.
 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- 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 they are the same temperature as the 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 in pattern indicated.
- 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 in pattern of colors and sizes indicated.
- 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. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

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 exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply three coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thin-set, epoxy-resin terrazzo flooring and base.

1.2 DEFINITIONS

- A. Aggregate: Marble chips or other types of aggregate.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to terrazzo including, but not limited to, the following:
 - a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Review special terrazzo designs and patterns.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work. Show layout of the following:
 - 1. Divider strips.
 - 2. Control-joint strips.
 - 3. Accessory strips.
 - 4. Terrazzo patterns.
- C. 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. Terrazzo: 6-inch- square Samples.
 - 2. Accessories: 6-inch- long Samples of each exposed strip item required.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type of terrazzo material or product, from manufacturer.
- B. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Engage an installer who is a contractor member of NTMA.
 - 2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
- B. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
- C. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.
- C. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.
- D. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.
- B. FloorScore Compliance: Terrazzo floors shall comply with requirements of FloorScore Standard.

2.2 EPOXY-RESIN TERRAZZO

- A. Epoxy-Resin Terrazzo: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.
 - 1. Products: Subject to compliance with requirements, provide one of the following :
 - a. General Polymers; Sherwin Williams; Terrazzo 1100.
 - b. Key Resin Company; Key Epoxy Terrazzo.
 - c. Master Terrazzo Technologies LLC; Morricite.
 - d. TEC Specialty; H.B. Fuller Construction Products Inc; Tuff-Lite Epoxy Terrazzo.
 - e. Terrazzo & Marble Supply Companies; Terroxy Resin Systems.

- f. Desco Coatings, Inc.
- 2. Thickness: As indicated nominal.
- 3. Custom Mix Color and Pattern: Match Architect's sample.
- B. Materials:
 - 1. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate-crack preparation and reflective-crack reduction.
 - a. Reinforcement: Fiberglass scrim.
 - 2. Primer: Manufacturer's product recommended for substrate and use indicated.
 - 3. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
 - a. Physical Properties without Aggregates:
 - 1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
 - 2) Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
 - 3) Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
 - 4) Chemical Resistance: No deleterious effects by contaminants listed below after seven-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.
 - i) 30 percent sulfuric acid.
 - j) 5 percent acetic acid.
 - b. Physical Properties with Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:
 - 1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch per ASTM D 635.
 - 2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F for temperature range of minus 12 to plus 140 deg F per ASTM D 696.
 - 4. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
 - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
 - 5. Finishing Grout: Resin based.

2.3 STRIP MATERIALS

- A. Thin-Set Divider Strips: L-type angle, 3/8 inch deep by 1/4 inch wide.
 - 1. Material: As indicated .
 - 2. Top Width: As indicated.

- B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material 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 strips for exposed top edge of terrazzo base.
 - 2. Edge-bead strips for exposed edges of terrazzo.

2.4 MISCELLANEOUS ACCESSORIES

- A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.
 - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Anchoring Devices:
 - 1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and required for secure attachment to substrate.
- C. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- D. Resinous Matrix Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
- E. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.
 - 1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
 - 2. Acid-Base Properties: With pH factor between 7 and 10.
 - 3. Sealers shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Crack Isolation: Provide manufacturer recommended isolation for crack and control joints in the amount of 10% of the floor area to be covered for slabs on grade and 100% floor coverage for elevated slabs on deck.

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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.
- B. Concrete Slabs:
 - 1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

- 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. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
 - c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.
- C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - 1. Moisture Testing: Perform tests indicated below.
 - a. Calcium Chloride Test: Perform anhydrous calcium chloride test per ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform not less than two tests in each installation area and with test areas evenly spaced in installation areas.
 - b. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.
 - c. Test Method: Test for moisture content by method recommended in writing by terrazzo manufacturer. Proceed with installation only after substrates pass testing.
- D. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.
 - 1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

- A. Comply with NTMA's written recommendations for terrazzo and accessory installation.
- B. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
- C. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.
- D. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
- E. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
- F. Flexible Reinforcing Membrane:
 - 1. Prepare and prefill substrate cracks with membrane material.
 - 2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
 - 3. Reinforce membrane with fiberglass scrim.
 - 4. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
- G. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.
- H. Strip Materials:
 - 1. Divider and Control-Joint Strips:

- a. Locate divider strips in locations indicated.
- b. Install control-joint strips in locations indicated.
- c. Install control-joint strips with 1/4-inch gap between strips, and install sealant in gap.
- d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory Strips: Install in locations indicated.

3.4 REPAIR

- A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.5 CLEANING AND PROTECTION

- A. Cleaning:
 1. Remove grinding dust from installation and adjacent areas.
 2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.
- B. Sealing:
 1. Seal surfaces according to NTMA's written recommendations.
 2. Apply sealer according to sealer manufacturer's written instructions.
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 096623

SECTION 096723 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Decorative resinous flooring systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.2: For liquid-applied flooring components, documentation including printed statement of VOC content.
- C. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.
- D. Product Schedule: For resinous flooring. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- B. Material Certificates: For each resinous flooring component, from manufacturer.
- C. Material Test Reports: For each resinous flooring system.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

1.6 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.

1.7 PROJECT 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 not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide product indicated on the drawings or by one of the following:
 - 1. Stonhard, Inc.
 - 2. Tnemec Company, Inc.

2.2 MATERIALS

- A. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.3 DECORATIVE RESINOUS FLOORING

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base.
- B. System Characteristics:
 - 1. Color and Pattern: As indicated by product designation listed above.
 - 2. Wearing Surface: Textured for slip resistance.
 - 3. Overall System Thickness: 3/16 inch.
- C. Body Coats:
 - 1. Resin: Epoxy.
 - 2. Formulation Description: High solids.
 - 3. Application Method: Self-leveling slurry with broadcast aggregates.
 - a. Number of Coats: Two.
 - 4. Aggregates: Colored quartz (ceramic-coated silica).
- D. Topcoat: Sealing or finish coats.
 - 1. Resin: Aliphatic Moisture Cured Urethane.
 - 2. Formulation Description: High solids.
 - 3. Type: Clear.
 - 4. Finish: Gloss.
 - 5. Number of Coats: One.

2.4 ACCESSORIES

- A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: 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 as follows:
 - 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.
 - 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.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
 - b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
 - c. Perform 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.
 - 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
- D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.2 APPLICATION

- A. General: 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. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. 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: 4 inches high.
- C. Apply self-leveling slurry body coats in thickness indicated for flooring system.

1. Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.
 - D. Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.
 - E. Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat and to produce wearing surface indicated.
 - F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- 3.3 PROTECTION
- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular, carpet tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.3:
 - a. For carpet tile, documentation indicating compliance with testing and product requirements of CRI's "Green Label Plus" program.
 - b. For installation adhesive, documentation including printed statement of VOC content.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

1.3 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.

1.4 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. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.7 FIELD CONDITIONS

- A. Comply with CRI 104 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 occupancy levels 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.

1.8 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, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: Subject to compliance with requirements, provide product indicator in finish schedule.
- B. Color: As indicated in finish legend.
- C. Pattern: As indicated in finish legend.

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 complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

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 wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer 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. 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.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

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- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

- A. Product Data: For the following, including installation recommendations for each type of substrate:
 - 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.3:
 - a. For carpet, documentation indicating compliance with testing and product requirements of CRI's "Green Label Plus" program.
 - b. For carpet cushion, documentation indicating compliance with testing and product requirements of CRI's "Green Label" program.
 - c. For installation adhesive, including printed statement of VOC content.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet: 12-inch- square Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
 - 3. Carpet Seam: 6-inch Sample.
 - 4. Mitered Carpet Border Seam: 12-inch- square Sample. Show carpet pattern alignment.

1.2 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Sample Warranties: For special warranties.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, 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.

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. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet[and carpet cushion] identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.7 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET

- A. Products: Subject to compliance with requirements, provide carpet indicated in finish schedule.
- B. Color: Match Architect's samples .
- C. Pattern: Match Architect's samples.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
 - 1. Use adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- D. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

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 performance. Examine carpet for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- 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 wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

- A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
 - 1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
- B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

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- G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer .

END OF SECTION 096816

SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl wall covering.
2. Hygienic vinyl wall covering.
3. Cork wall covering.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
2. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

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. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

1. Wood-Veneer Wall Coverings: Condition spaces for not less than 48 hours before installation.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.2 VINYL WALL COVERING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Koroseal Walltalkers; NU-VU-RITE-WHITE, 60 inches wide with aluminum "J" trim on three sides and marker tray at bottom.
- B. Colors, Textures, and Patterns: As indicated on the drawings.

2.3 HYGIENIC VINYL WALL COVERING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.
- B. Accessories: Manufacturer's standard welding rod, color to match panels.

2.4 CORK WALL COVERINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product approved by the Architect.
 - 1. Bulletin Board Sheet and Adhesive.
 - a. Description: 100% cork.
 - b. Width: As indicated by selected material.
 - c. Thickness: As indicated by selected material.
 - d. Backing: Unbacked.
 - e. Adhesive: Manufacturer's recommended adhesive for surface being applied to.

2.5 ACCESSORIES

- A. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.
 - 1. Adhesive shall have a VOC content of 50 g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Primer/Sealer: Mildew resistant, complying with requirements in Section 099123 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.
- C. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended in writing by wall-covering manufacturer.
 - 1. Adhesive shall have a VOC content of 50 g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Seam Tape: As recommended in writing by wall-covering manufacturer.
- E. Marker Tray:

1. Basis-of-Design Product: Wall Talkers aluminum marker tray.
2. Finish: Clear anodized aluminum with aluminum end caps.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
 2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 3. Metals: If not factory primed, clean and apply primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 4. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
 5. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 WALL LINER INSTALLATION

- A. Install wall liner, without gaps or overlaps. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

3.4 WALL-COVERING INSTALLATION

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.
- C. Install strips in same order as cut from roll.
 1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.
- E. Match pattern 72 inches above the finish floor.

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- F. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.5 CLEANING

- A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended in writing by wall-covering manufacturer.
- C. Replace strips that cannot be cleaned.
- D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 097610 – CONCRETE SEALER

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes.
 - 1. Sealing of new exposed concrete floor areas where scheduled on the Drawings as "sealed" concrete.

1.2 SUBMITTALS

- A. Product Data: Submit complete printed data indicating preparation and application.

1.3 QUALITY ASSURANCE

- A. Applicator: A party qualified by experience with the product for a minimum of three (3) years.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver in manufacturer's original, unopened containers bearing labels.
- B. Store in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. One (1) component transparent acrylic copolymer sealing and dusting compound, ASTM C309. Provide one of the following:
 - 1. W.R. Meadows; VOCOMP-20
 - 2. Euclid; Diamond Clear VOX
 - 3. Spec-Chem Cure and Seal WB
- B. Provide sealer that meet or exceed the VOC limits of the South Coast Air Quality Management District Rule #1168.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Thoroughly clean substrate of all contaminants that may interfere with bond.
- B. Allow floor to thoroughly dry and new concrete to cure 30 days.

3.2 APPLICATION

- A. Provide adequate ventilation to outside to avoid any fumes.
- B. Apply in two separate coats at a minimum rate of approximately 350 sq. ft. per gal. each coat.

3.3 PROTECTION

- A. Close area to traffic until dry.

END OF SECTION 097610

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SECTION 097713 - STRETCHED-FABRIC WALL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes site-upholstered wall systems.

1.2 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include fabric facing, frame edge and trim, core material, and mounting indicated.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4.1: For adhesives, documentation indicating that products 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. Shop Drawings: For each stretched-fabric system.
 - 1. Include plans, elevations, sections, and installation and system details.
 - 2. Include details at head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate frame-edge profile and core materials.
 - 3. Include details at cutouts and penetrations for other work.
 - 4. Include direction of fabric weave and pattern matching.
 - 5. Show sewn-seam locations, types, and methods.
- D. Samples for Initial Selection: For each type of fabric facing.
 - 1. Include Samples of accessories involving color or finish selection.
- E. Samples for Verification: For the following products:
 - 1. Fabric: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
 - 2. Frame System: 12-inch- square Sample(s) showing each edge profile and corner.
 - 3. Core Material: 12-inch- square Sample at corner.
 - 4. Assembled System: Approximately 36 by 36 inches , including joints and seams in mockup.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
 2. Items penetrating or covered by stretched-fabric systems including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Alarms.
 - e. Sprinklers.
 - f. Access panels.
 3. Show operation of hinged and sliding components covered by or adjacent to stretched-fabric systems.
- B. Qualification Data: For Installer.
- C. Product Certificates: For each type of stretched-fabric system.
- D. Sample Warranty: For special warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For stretched-fabric systems to include in maintenance manuals. Include fabric manufacturer's written cleaning, stain-removal, restretching, and reupholstering instructions.
- 1.7 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. Fabric: For each fabric, color, and pattern installed, furnish length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.
 2. Framing and Related Installation Items: Furnish manufacturer's full-length units equal to 5 percent of amount installed, but no fewer than **[five]** **<Insert number>** units, including unopened adhesives.
- 1.8 QUALITY ASSURANCE
- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Comply with fabric and stretched-fabric system manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.
- 1.10 FIELD CONDITIONS
- A. Environmental Limitations: Do not install stretched-fabric systems until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install stretched-fabric systems until a permanent level of lighting is provided on surfaces to receive stretched-fabric systems.

- C. Air-Quality Limitations: Protect stretched-fabric systems from exposure to airborne odors such as tobacco smoke, and install systems under conditions free from odor contamination of ambient air.

1.11 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of stretched-fabric systems that fail in performance, materials, or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Acoustical performance.
 - b. Fabric sagging, distorting, or releasing from panel edge.
 - c. Warping of core.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain stretched-fabric wall systems specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Stretched-fabric wall systems 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. Fire-Test-Response Characteristics: Stretched-fabric wall systems shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency on systems prepared according to ASTM E 2573. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 286.

2.3 STRETCHED-FABRIC WALL SYSTEMS

- A. Stretched-Fabric Wall System : Manufacturer's standard system consisting of facing material stretched tightly over a frame and secured in the frame.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Clipso Ceiling and Wall; Clipso Standard.
 - 2. Frame Edge: Radiused (bullnosed) profile.
 - a. Fabric-Insertion Point: Side load.
 - 3. Facing Material: As indicated on Drawings.

2.4 INSTALLATION MATERIALS

- A. Installation Products: Concealed on back of system, recommended by stretched-fabric system manufacturer to support weight of system, fabric tension, and as follows:
 - 1. Adhesives: As recommended by stretched-fabric system manufacturer and with a VOC content of 70 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, materials, substrates, areas, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of stretched-fabric systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each area and establish layout of panels and joints of uniform size with balanced borders at opposite edges within a given area.
- B. Before installation, allow fabric to adjust and become stable in spaces where it will be installed according to stretched-fabric system manufacturer's written instructions. Acclimatize fabric for minimum of 24 hours at ambient temperature and humidity conditions indicated for spaces when occupied for their intended use.

3.3 INSTALLATION

- A. Install stretched-fabric systems according to system manufacturer's written instructions.
 - 1. Provide continuous perimeter frames of each profile indicated, designed to be inconspicuous when covered by fabric facing, with smooth edges, and with surface finish that will not telegraph through fabric facing.
 - 2. Install framing around penetrations.
 - 3. Tightly fit framing to adjacent construction and securely attach to substrate.
 - 4. Install core material with full coverage, flush with face of stretched-fabric system frame.
 - 5. Attach frame and core to substrate with adhesive or fasteners or both to support system and prevent deformation of components.
 - 6. Install stretched-fabric systems level and plumb unless otherwise indicated, true in plane, and with fabric square to the grain.
 - 7. Install jointed panels with **[butt joints]** **[and]** **[reveals]** **<Insert requirement>** as indicated.
- B. Fabric Installation: Apply fabric monolithically in continuous run over area, without joints or reveals, except where panel joints or midspan frames are indicated.
 - 1. Fabric Direction: Run fabric railroaded.
 - 2. Fabric Sequence: Maintain sequence of fabric drops; match and level fabric pattern and grain.
 - 3. Fabric Alignment: Install fabric with patterns or directional weaves so pattern or weave aligns with adjacent panels.
 - 4. Fabric Seams: Sewn seams are not permitted.
 - 5. Stretch and secure fabric to frame edges and so frame and frame attachment method are concealed by fabric unless otherwise indicated.
 - 6. Stretch fabric tightly and square without puckers, ripples, or distortions. Acclimatize and restretch if recommended by stretched-fabric system manufacturer. Repair distortions, wrinkles, and sagging.

3.4 INSTALLATION TOLERANCES

- A. Edge Straightness: Plus or minus 1/16 inch in 48 inches .
- B. Variation from Level and Plumb: Plus or minus 1/16 inch in 48 inches , noncumulative.
- C. Variation of Joint Width: Not more than 1/16 inch in 48 inches from hairline, noncumulative.

3.5 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 097713

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SECTION 098310 - ACOUSTICAL PLASTER SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Acoustical backing panel.
 - 2. Field-applied seamless acoustical plaster finish.

1.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written installation instructions.
- B. Shop Drawings: Show details of substrate joints, components, and attachments to other work.
- C. Fire Resistance: Provide Certified Reports on Surface Burning Characteristics Determined by ASTM E 84, conducted by a recognized, independent, testing agency, shall be submitted and meet the following minimum requirements:
 - 1. Flame Spread: Class A
 - 2. Smoke Development: Class A.
- D. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.
 - 2. Plaster Finishes: Provide 24 inch square sample for each textured finish indicated and on same backing indicated for Work, including insulation.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer shall have produced specified or similar products for a minimum of 5 years prior to bid, and have used products in similar scope, on projects of similar scale and type. Manufacturer shall have the capacity to produce and deliver products on schedule as required for the Work.
- B. Installing Contractor Qualifications:
 - 1. Installing contractor shall be certified, licensed, or otherwise approved by manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
 - 2. Installing contractor shall have installed specified or similar products on a minimum of 5 projects of similar scale and type within 5 years prior to bid.
 - 3. Installing contractor's superintendent shall have installed specified or similar products on a minimum of 5 projects of similar scale and type within 5 years prior to bid, and have used specified products in a similar scope on projects of similar scale and type within past 12 months.

- C. Mockups: Before beginning installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each texture finish indicated.
 - 2. Simulate finished lighting conditions for review of mockups.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical finish until spaces are enclosed and weather tight, wet work in spaces is complete and dry, work at and above ceilings is complete. Maintain 60 - 90 degrees F ambient temperature and 70 percent relative humidity maximum. This condition should be maintained during and after the installation. Ventilate building space during acoustical finish application and until dry.
- B. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

- A. Noise reductions Coefficient: NRC 0.85; ASTM C423 - 07a Test Mounting Type E-400.
- B. Flame Spread: Class A with flame spread and smoke development <25; ASTM E84.
- C. Light Reflectance: 93; ASTM E1477.
- D. VOC:
 - 1. Acoustical Plaster: Less than or equal to 3 grams per liter per ASTM D3960.
 - 2. Primer: Less than or equal to 23 grams per liter per EPA Method 24.
 - 3. Acoustical Coating: Less than or equal to 3 grams per liter per ASTM D3960.
- E. Acoustical Plaster: Less than or equal to 3 grams per liter per ASTM D3960.
- F. Primer: Less than or equal to 23 grams per liter per EPA Method 24.
- G. Acoustical Coating: Less than or equal to 3 grams per liter per ASTM D3960.
- H. Mold: Meets ASTM D3273/ASTM D3274 mold specification requirements.
- I. Internal Stress: 2.1 rating; ASTM D6991.
- J. Compressive Strength: Minimum 150 psi; ASTM E761.
- K. Density: 1.87 lbs/ft; ASTM E605.

2.2 ACOUSTICAL PLASTER SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. BASWAphon (Basis-of-Design; Classic Fine Finish)
 - 2. Fellert Acoustical
- B. Application: APS surfaces greater than 7 feet above finish floor.
- C. Thickness: 2 inches, unless specifically noted otherwise.
- D. NRC: 0.90 minimum.
- E. Acoustical Board: Manufacturer's standard pre-coated glass fiber or mineral fiber board.
- F. Primer: Manufacturer's recommended primer.
- G. Coating: Manufacturer's recommended coating to achieve NRC rating required.
 - 1. Color: White.
- H. Accessory Components:
 - 1. Adhesive: Manufacturers edge seam adhesive.
 - 2. Foam tape: Manufacturers isolating foam tape, 1/ 4 inch thick.
 - 3. Beads and Trims: As recommended by manufacturer.

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. 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 thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Comply with manufacturer's written instruction for substrate preparation.
 - 1. Gypsum board finished to level 4.
 - 2. Surface is clean, sound, and secure to framing.
 - 3. Protect adjacent surfaces.
- C. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with applicable portions of ASTM C 840 and manufacturer's instructions.
- B. Install panels 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 12 inches.
- C. Isolate perimeter of panels with foam tape. Trim edges with edge trim where edges of panels are exposed. Seal exposed face of foam tape with acoustical sealant specified in Section 079200.

- D. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at through penetrations.

3.3 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. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
- C. Aluminum Trim: Install in locations indicated on Drawings.

3.4 FINISHING PANELS

- A. General: Treat joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare surfaces for acoustical plaster finish. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas with specified adhesive.
- C. Apply acoustical plaster
 - 1. Install base coat plaster in 2 coats over all surfaces. Cure as recommended by manufacturer.
 - 2. Install finish plaster over entire surface. Trowel smooth without visible seams, ridges, tool marks or other imperfections. Cure as recommended by manufacturer.

3.5 PROTECTION

- A. Protect adjacent surfaces from plaster and adhesive and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 098310

SECTION 098413 - FIXED SOUND-ABSORPTIVE WOOD PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Acoustic wood panels, with perforation on face and rear, with paint finish.
 - 2. Mounting system.
 - 3. Trim and accessories.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate installation of acoustical material with installers of related work including, but not limited to, building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical data circling all applicable components for the specified product. For each unique item or type of material specified in this section a separate sheet shall be submitted.
- B. Shop Drawings: Submit drawings for all areas that contain the material including floor plans, elevations and RCPs where applicable. Drawings will be created from architect supplied base drawings that are provided electronically. The drawings should show overall layout with dimensions, panel identification, and should define all attachments and perimeter circumstances. Coordinate drawings with any other trades that interact with the specified material. Field verify site conditions as required with dimensions on drawings.
- C. Samples: Submit physical samples of product to be supplied on the project that are typical of the veneer, finish, cut, and type specified. Sample shall be at least 6 by 6 inches in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: From independent laboratories to prove that material is meeting the specification.

1.5 QUALITY ASSURANCE

- A. Product shall be manufactured in a very specific process so as to leave the microperforated holes open and clear to allow sound to pass through and for the product to perform as designed.
- B. This process shall have a very specific order of manufacturing and assembly.
 - 1. MDF Core will be perforated according to specifications for the product.
 - 2. All finishing, edge work, joinery work, or any other modifications to panels are to be completed.
 - 3. The final layer must, in all circumstances, be the microperforation of the veneer.
- C. Installer Qualifications:
 - 1. Installer for material must be an experienced installer approved by the wood acoustical product manufacturer.
 - 2. Installer must have completed similar projects in design and extent to that indicated for this project with a record of successful in-service performance.
 - 3. Installer must have at least 3 years of experience in similar project work

- D. All wood acoustic materials must be sourced from a single fabricator with in-house shop drawing capabilities, in-house finishing and assembly, and with resources to provide products of consistent quality in appearance and physical properties without delaying the project.
- E. Manufacturer shall conform to Architectural Woodworking Institute quality standards.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver material to site in the original, unopened packages and protect unopened packaging in a fully enclosed space from damage, moisture, direct sunlight, surface contamination, and any other mistreatment. Do not handle or unpack finished products until the material is ready to be installed and the project environmental requirements have been fully met.
- B. Before installing, product must acclimate in intended installation area and must be done at the intended operational temperature and humidity. This procedure of acclimatization is a length of at least 72 hours.
- C. Handle products with proper care to avoid chipping edges, scratching the surface, scuffing the material, denting the material, or damaging the units in any way.
- D. Protect installed product from any other trade work that must be completed in or around the area of installation.

1.7 FIELD CONDITIONS

- A. Prior to opening original packaging or installing material, ensure that the spaces are enclosed and completely weatherproof, all wet-work is complete and dry, all other trades above or behind wood acoustic materials is complete, and the building temperature and humidity conditions are consistently maintained at the levels indicated for the building once occupied.
- B. Project occupied humidity must be between 35-60 percent. Do NOT install products if humidity exceeds 65 percent.
- C. Project occupied temperature must be maintained between 64 and 85 d F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Topakustik; Topperfo Micro Panel.

2.2 DESCRIPTION

- A. Dual method sound absorption through tuned resonant absorption and viscous losses in sub-millimeter perforations. Absorption through viscous losses is only possible with the perforation diameter is comparable to the boundary layer of air, which is roughly 0.5 mm. Microperforation will thus be defined as 0.5 mm holes in a 1 mm veneer layer that is adhered to a MDF substrate that is maximally perforated.

2.3 PERFORMANCE REQUIREMENTS

- A. Material must meet performance data as indicated below and measured according to ASTM C423 or ISO 354. Random incidence absorption data in third-octave bands are as follows:
 - 1. Surface Mounted, 2 inch total system depth
 - a. Perforations: 0.5 mm diameter.
 - b. Spacing: 2/2 mm o.c.
 - c. Octave Band (Hz) Absorption Coefficients:

- 1) 125: 0.48
- 2) 250: 0.80
- 3) 500: 0.93
- 4) 1000: 0.95
- 5) 2000: 0.77
- 6) 4000: 0.73

d. NRC: 0.90

B. Fire Performance Characteristics

- 1. Panels provided must have surface burning characteristics as determined by testing panel components in accordance with ASTM E84 test procedures. Depending on material core specified they must comply with the following:
 - a. Class A (or 1) – Fire rated medium density fiberboard (MDF) B1 core with maximum flame spread rating: 25 and maximum smoke developed: 450.

2.4 MATERIALS

- A. Face Profile: 2/2/0.5, first two numbers describe the distance between holes vertically and horizontally and the third number describes the diameter of the perforation.
- B. Rear Perforation: M-hole perforation – standard perforation of MDF panel (single diameter through MDF).
- C. Core: ASTM E-84, Class A fire rated medium density fiberboard (MDF) core.
- D. Surface:
 - 1. Custom paint color as selected by architect.
 - 2. Clear coat protective varnish over paint finish as specified by architect.
- E. Finish: Natural lacquer with satin finish.
- F. Material size as shown on the drawings.
- G. Edge: Edgebanding on all sides of panels.
- H. Border: Perforations on panel face stop short of panel edge by 0.5 inches.
- I. Backing: Black, nonwoven glass fiber matt (60 g/m² density) shall be adhered to rear of panel for any absorptive panel.
- J. Acoustic insulation to be included behind panels as specified by architect and provided by installer 1-1/2 inches fiberglass.
- K. Z-clip or Z-bar installation, clips supplied by installer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. General:
 - 1. Examine installation areas for compliance with all manufacturer and project environmental requirements.
 - 2. Ensure that uninstalled products have been handled correctly and have acclimated to the final environmental conditions.
 - 3. Review all substrates and structural framing that will be adjacent to panels, with installer present, for compliance and adherence to project requirements, specifications, and manufacturer suggestions.

4. Inspect installation areas to confirm that all surfaces are dry, clean, level, plumb, and constructed according to contract documents.
5. Do not proceed with installation until unsatisfactory conditions are corrected and approved.

B. Coordination

1. Coordinate with other trades in the vicinity of installation.
2. All wet work must complete and dry.
3. Coordinate with all other trades to verify that components that will integrate with acoustic system have been addressed and clarified prior to installation of material.

3.2 PREPARATION

- A. Protect all adjacent surfaces from possible damage during installation of material.

3.3 INSTALLATION

- A. Panels must be installed such that all joints allow for the material to expand and contract with temperature and humidity changes. Failure to follow this guideline will result in panels that buckle or warp over time.
- B.

3.4 REPAIR

- A. Remove and replace at no additional charge any materials that cannot be repaired or cleaned to the Owner's and Architect's satisfaction.

3.5 ADJUSTING AND CLEANING

- A. Adjust panels during installation and after to ensure that all surfaces, joints, and perforations are aligned, and that all units are flush, level and plumb. Adjust any access panels to ensure that all hardware is secure and that all panels are operable.
- B. Clean exposed surfaces of planks after installation is complete. Comply with manufacturer's cleaning and maintenance instructions. Remove all dust with vacuuming and do not scratch exposed surfaces with any metal components to vacuums or other cleaning appliances. Do not use abrasive cleaners or cloths that can scratch wood finishes. Remove any dirt, dust, grease, oils and fingerprints.
- C. Upon completion of work, all exposed surfaces must be covered and protected from any damage or soiling until project substantial completion and owner occupancy.

END OF SECTION 098413

SECTION 098433 - SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
 - 1. Sound-absorbing wall panels.

1.2 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
 - 2. Certificates for Credit MR 7: Chain-of-custody certificates indicating that wood-based products used in units comply with forest certification and chain-of-custody requirements. Include statement indicating cost for each certified wood product.
 - 3. Product Data for Credit IEQ 4.4: For composite wood products used in units, documentation indicating that product contains no urea formaldehyde.
- C. Shop Drawings: For unit assembly and installation.
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 - 3. Include details at cutouts and penetrations for other work.
- D. Samples for Verification: For the following products:
 - 1. Panel: 12-inch- square Sample(s) showing each edge profile, corner, and finish.
 - 2. Core Material: 12-inch- square Sample at corner.
 - 3. Mounting Devices: Full-size Samples.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Electrical outlets, switches, and thermostats.
 - 2. Items penetrating or covered by units including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.

- d. Alarms.
- e. Sprinklers.
- f. Access panels.

B. Product Certificates: For each type of unit.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

- A. Sound-Absorbing Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Golterman & Sabo; Acousti-Impact Panel, 1 inch thick; AIP 1 or comparable product approved by the Architect and Acoustical Engineer.
 - 2. Panel Shape: Flat.
 - 3. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
 - 4. Core: Glass-fiber board.
 - a. Core-Face Layer: Manufacturer's standard impact-resistant, acoustically transparent, copolymer sheet.
 - 5. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
 - 6. Edge Profile: Square.
 - 7. Corner Detail in Elevation: Square with continuous edge profile indicated.
 - 8. Facing Material: As indicated on Drawings.
 - 9. Acoustical Performance: Sound absorption NRC of 0.85 according to ASTM C 423 for Type A mounting according to ASTM E 795.
 - 10. Nominal Core Thickness: 1 inch.

11. Panel Width: As indicated on Drawings.
12. Panel Height: As indicated on Drawings.

2.2 MATERIALS

- A. Core Materials: Manufacturer's standard.
 1. Glass-Fiber Board: ASTM C 612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft., unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
 2. Impact-Resistant, Acoustically Transparent, Copolymer Sheet for Face Layer: 1/16- to 1/8-inch- thick layer of perforated, noncombustible, copolymer sheet laminated to face of core.
- B. Facing Material: Fabric from same dye lot; color and pattern as indicated on Drawings.
- C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
 1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.3 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.
- C. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.
- D. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
 1. Square Corners: Tailor corners.
 2. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.
- E. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
 1. Thickness.
 2. Edge straightness.
 3. Overall length and width.
 4. Squareness from corner to corner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. All wet work must complete and dry.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.
- B. Variation of Joint Width: Not more than 1/32-inch variation from hairline in 48 inches, noncumulative.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

SECTION 098453 – PARTITION CLOSURE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Extruded aluminum partition closures at curtain wall and aluminum storefront.
2. Sound barrier partition closures at curtain wall and aluminum storefront.

1.2 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for partition closures.

B. Shop Drawings:

1. Include dimensioned cross-section(s) at location where partition terminates at perimeter mullion, and indicate finish.

C. Samples: For each exposed product and for each color and texture specified.

1. Size: 12 inches .

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO-9001 certified manufacturer of aluminum extrusions and anodizing.

B. Installer Qualifications: Entity employing installers and supervisors trained and approved by partition closure manufacturer.

C. Testing Agency Qualifications: Provide ASTM E 90 testing by laboratory accredited by IAS as complying with ISO/IEC Standard 17025.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver partition closures until spaces to receive them are clean, dry, and ready for their installation.

B. Store partition closures in original undamaged packaging inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.6 WARRANTY

A. Partition Closure Manufacturer's Warranty: Manufacturer agrees to repair or replace partition closures that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years limited warranty 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXTRUDED ALUMINUM PARTITION CLOSURES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide "Mullion Mate Extruded Aluminum Partition Closures" by Gordon Interior Specialties Division, Gordon, Inc. or comparable products.
- B. System Description: Provide extruded aluminum partition closures of design, basic profile, materials, and operation indicated on Drawings. Provide units capable of accommodating variations in adjacent surfaces.
 - 1. Size: As required to securely close openings indicated on Drawings and provide specified sound transmission ratings.
 - 2. Sound Transmission: Materials and assemblies tested in accordance with ASTM E90:
 - a. STC 38 or greater.
 - 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
- C. Materials And Accessories
 - 1. Aluminum Extrusions: 6063-T5 temper extruded aluminum with tensile strength of 31 ksi when tested in accordance with ASTM B221/B221M.
 - a. Thickness: 0.125 inches.
 - b. Profile: As indicated on Drawings or as selected by Architect to allow solid attachment and fastening to partition wall framing.
 - 2. Partition Closure Plate: Provide closure plate to finish end of partitions, sized for partition thickness.
 - 3. Gasket: Manufacturer's standard compressible foam gasket between edge of extrusion and interior face of curtain wall framing, aluminum storefront framing, or glass assembly.
 - a. Color: Black.
 - 4. Sound Attenuation Blankets: As specified in Division 09 Section "Gypsum Board."
 - 5. Fasteners: Self-tapping stainless steel fasteners.
 - 6. Acoustical Sealant: Non-sag, paintable, non-staining, latex sealant, complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - a. Products: Subject to compliance with requirements, provide **[one of]** the following:
 - 1) Acoustical Sealant for Exposed and Concealed Joints:
 - a) Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.

b) United States Gypsum Co.; SHEETROCK Acoustical Sealant.

b. Color: As selected by Architect from manufacturer's full range of colors.

2.2 SOUND BARRIER PARTITION CLOSURES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide following Sound Barrier Mullion Trim Cap Assemblies by MULL-it-OVER Products or comparable products.
 - 1. Profile: 57 Classic Mullion Trim Cap.
- B. System Description: Provide sound barrier mullion trim caps of design, basic profile, materials, and operation specified and shown on Drawings. Provide units capable of accommodating variations in adjacent surfaces.
- C. Performance Requirements
 - 1. Sound Transmission: Materials and assemblies tested in accordance with ASTM E90:
 - a. Single Sided Applications: STC 51 or greater.
 - b. Double Sided Applications: STC 57 or greater.
 - 2. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
- D. Materials And Accessories
 - 1. Aluminum Extrusions:
 - a. Thickness: 0.125 inches.
 - b. Profile: As selected and approved by Architect to allow solid attachment and fastening to the partition wall framing.
 - 2. Sound Absorbing Foam Backing:
 - a. Fire Rating: ASTM E 84 Class 1.
 - b. Fungi Resistance: Zero rating per ASTM G 21.
 - 3. Compressible Foam: Provide compressible foam gasket between edge of extrusion and interior face of curtain wall framing, aluminum storefront framing, or glass assembly.
 - a. Thickness: Standard 5/16 inch, compressible to 1/4 inch, or larger thickness to accommodate a larger mullion deflection.
 - b. Color: Black.
 - 4. Fasteners: Self-tapping stainless steel fasteners.
 - 5. Snap Cover: Aluminum snap-on trim to cover fasteners.
 - 6. Acoustical Sealant: Provide material specified in Division 07 Section "Joint Sealants"

2.3 FABRICATION

- A. Ship extrusions and profiles in custom lengths as required to meet project requirements

2.4 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Comply with partition closure manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- B. Examine walls and adjacent curtain wall or aluminum storefront for suitable conditions where partition closure will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install partition closure in accordance with manufacturer's written recommendations.
- B. Apply partition closure component to end of gypsum board partitions prior to finishing partitions.
- C. Apply continuous bead of acoustical sealant to gasket surfaces and to all joints between partition closure and other surfaces.

3.3 CLEANING AND PROTECTION

- A. Clean all surfaces following installation as recommended by manufacturer.
- B. Protect finishes from damage during construction period.
- C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Replace components that cannot be refinished in the field as directed by Architect

END OF SECTION 098453

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit EQ 4: For paints and coatings, documentation indicating that they meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Draw-Down Samples: Provide 3 "draw-down" samples of each specified sheen, color and finish.
- D. 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. VOC content.

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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.
- B. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product by color and finish was used, product data pages, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.4 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.

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

1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 1. Benjamin Moore & Co.
 2. PPG Paints
 3. Rust-Oleum
 4. Sherwin-Williams Company (The).
- B. Products: Subject to compliance with requirements, provide one of the products listed in "Exterior Painting Schedule" article in Part 3 below for the paint category indicated.

2.2 PAINT, GENERAL

- A. 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.
- B. Performance Requirements
 1. VOC Content: Provide materials that [comply with VOC limits as referenced in Section 018113 – Sustainable Design Requirements] [meet or exceed the VOC limits of South coast Air Quality Management District Rule #1168].
- C. Colors: As indicated in a color schedule .

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 (Clay and CMU): 12 percent.
 - 3. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- F. 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 and MPI Architectural Painting Specification Manual as 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.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations.
 - 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. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. 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:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.

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.

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- 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. Ferrous Metal:

1. Semi-Gloss Sheen:

a. Benjamin Moore & Co.:

- 1) Primer (Unpainted Surfaces): SUPER SPEC HP Acrylic Metal Primer P04.
- 2) First and Second Coats: SuperSpec Acrylic Latex Semigloss #170.

b. PPG Paints:

- 1) Primer (Unpainted Surfaces): Pitt-Tech Plus WB Industrial DTM Metal Primer 90-912.
- 2) First and Second Coats: Pitt Tech Plus 90-1210 Semi-Gloss DTM Enamel.

c. Rust-Oleum:

- 1) Primer: Rust-Oleum Universal Acrylic Primer 1-2 mils DFT
- 2) First & Second Coats: Rust-Oleum Zinsser Perma White Exterior Acrylic Semi-Gloss @ 1.5-2.0 mils DFT

d. Sherwin-Williams Company:

- 1) Primer (Unpainted Surfaces): Pro-Cryl Universal Primer, B66-310 Series.
- 2) First and Second Coats: DTM Acrylic Coating S/G B66-200.

B. Zinc-Coated (Galvanized) Metal:

1. Semi-Gloss Sheen:

a. Benjamin Moore & Co.:

- 1) Primer: Super Spec HP Acrylic Metal Primer P04.
- 2) First and Second Coats: SuperSpec Acrylic Latex Semigloss #170.

b. PPG Paints:

- 1) Primer: Pitt-Tech Plus WB Industrial DTM Metal Primer 90-912 Series.
- 2) First and Second Coats: Pitt Tech Plus Semi-Gloss DTM Industrial Enamel 90-120 Series.

c. Rust-Oleum:

- 1) Primer: Rust-Oleum Universal Acrylic Primer 1-2 mils DFT

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- 2) First & Second Coats: Rust-Oleum Zinsser Perma White Exterior Acrylic Semi-Gloss @ 1.5-2.0 mils DFT. per coat.
- d. Sherwin-Williams Company:
 - 1) Primer: Pro-Cryl Universal Primer, B66-310 Series.
 - 2) First and Second Coats: DTM Acrylic Coating Semi-Gloss, B66-200 Series.

ND OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For paints and coatings, including printed statement of VOC content.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Draw-Down Samples: Provide 3 "draw-down" samples of each specified sheen, color and finish.
- D. 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. VOC content.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Materials: 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. of each material and color applied.
- B. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product by color and finish was used, product data pages, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Storage: 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.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Ambient Conditions:

1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between **50 and 95 deg F**.
2. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than **5 deg F** above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Benjamin Moore & Co.
2. PPG Paints.
3. Rust-Oleum
4. Sherwin-Williams Company.

B. Products: Subject to compliance with requirements, provide one of the products listed in "Interior Paint Schedule" article in Part 3 below for the paint category indicated or an acceptable comparable product.

2.2 PAINT, GENERAL

A. 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.

B. Colors: As indicated in a color schedule .

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. 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 and MPI Architectural Painting Specifications Manual as applicable to substrates 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 if any.
- 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. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- E. 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.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. PVC Piping: Remove dust, dirt, clear coat and other material that may impair bond of paint.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but 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 in occupied spaces:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.
 - f. Other items as directed by Architect.
 - 2. 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 INTERIOR PAINT SCHEDULE

A. Gypsum Board:

1. Flat Sheen:

a. Benjamin Moore & Co.:

- 1) Primer (Unpainted Surfaces): Ultra Spec 500 Waterborne Zero VOC Primer Sealer N534.
- 2) First and Second Coats: Ultra Spec 500 Waterborne Zero VOC Flat N536.

b. PPG Paints:

- 1) Primer (Unpainted Surfaces): Speedhide Zero Int. Latex Quick Drying Primer/Sealer, 6-4900XI.
- 2) First and Second Coats: Speedhide Zero Interior Semi-Gloss Latex Enamel, 6-4510XI Series.

c. Rust-Oleum:

- 1) Primer: Rust-Oleum Zinsser Drywall Primer (Low VOC).
- 2) First & Second Coat: Zinsser Perma White Interior Flat Matte Eggshell Acrylic (Low VOC).
- 3) Primer (Unpainted Surfaces): Rust-Oleum Zinsser Bulls Eye Zero VOC(No VOC Option).

d. Sherwin-Williams Company:

- 1) Primer (Unpainted Surfaces): ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
- 2) First and Second Coats: ProMar 200 Zero VOC Interior Latex Flat, B30-2650 Series.

2. Low-Luster, Satin or Eggshell Sheen:

a. Benjamin Moore & Co.:

- 1) Primer (Unfinished Surfaces): Ultra Spec 500 Waterborne Interior Primer Sealer N534.
- 2) First and Second Coats: Ultra Spec 500 Waterborne Zero VOC Eggshell Enamel N538.

b. PPG Paints:

- 1) Primer (Unfinished Surfaces): Speedhide ZeroLatex Quick Drying Primer/Sealer, 6-4900XI.
- 2) First and Second Coats: Speedhide Zero Interior Eggshell Latex 6-4310 Series.

c. Rust-Oleum:

- 1) Primer: Rust-Oleum Zinsser Drywall Primer (Low VOC).
- 2) First & Second Coat: Zinsser Perma White Interior Satin Acrylic (Low VOC).

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- 3) Primer (Unpainted Surfaces): Rust-Oleum Zinsser Bulls Eye Zero VOC(No VOC Option).
 - 4) First & Second Coat: Rust-Oleum Sierra Performance Beyond Satin No VOC(No VOC Option).
 - d. Sherwin-Williams Company:
 - 1) Primer (Unfinished Surfaces): ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 2) First and Second Coats: ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2650 Series.
- B. Mechanical and Electrical Items: Use 3-coat system best suited to substrate, satin finish. Use heat resistant materials where required.
- C. Ferrous Metal:
 1. Satin or Eggshell Sheen:
 - a. Benjamin Moore & Co. :
 - 1) Primer (Unfinished Surfaces): Acrylic Metal Primer P04.
 - 2) First and Second Coats: Ultra Spec 500 Waterborne Interior Eggshell N538.
 - b. PPG Paints:
 - 1) Primer (Unfinished Surfaces): Pitt Tech Plus WB Int./Ext. Industrial Primer DTM 90-912 Series.
 - 2) First and Second Coats: Speedhide Zero Interior Eggshell Latex Enamel, 6-4310XI Series.
 - c. Rust-Oleum:
 - 1) Primer: Rust-Oleum Universal Acrylic Primer (Low VOC).
 - 2) First & Second Coat: Zinsser Perma White Interior Satin Acrylic (Low VOC).
 - 3) Primer (Unpainted Surfaces): Rust-Oleum Sierra Performance Griptec Zero VOC (No VOC Option).
 - 4) First & Second Coat: Rust-Oleum Sierra Performance Beyond Satin No VOC (No VOC Option).
 - d. Sherwin-Williams Company:
 - 1) Primer (Unfinished Surfaces): Pro-Cryl Universal Primer, B66-310 Series.
 - 2) First and Second Coats: ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series.
- D. Zinc-Coated (Galvanized) Metal:
 1. Satin or Egg-Shell Sheen:
 - a. Benjamin Moore & Co.:
 - 1) Primer (Unfinished Surfaces): Super Spec HP Acrylic Metal Primer P04.
 - 2) First and Second Coats: Ultra Spec 500 Waterborne Interior Zero VOC Eggshell N538.

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b. PPG Paints:

- 1) Primer (Unfinished Surfaces): Pitt Tech Plus WB Int./Ext. Industrial Primer DTM 90-912 Series.
- 2) First and Second Coats: Speedhide Zero Interior Eggshell Latex Enamel, 6-4310XI Series.

c. Rust-Oleum:

- 1) Primer: Rust-Oleum Universal Acrylic Primer (Low VOC).
- 2) First & Second Coat: Zinsser Perma White Interior Satin Acrylic (Low VOC).
- 3) Primer (Unpainted Surfaces): Rust-Oleum Sierra Performance Griptec Zero VOC (No VOC Option).
- 4) First & Second Coat: Rust-Oleum Sierra Performance Beyond Satin No VOC (No VOC Option).

d. Sherwin-Williams Company:

- 1) Primer (Unfinished Surfaces): ProCryl Universal Primer, B66-310 Series.
- 2) First and Second Coats: ProMar 200 ZeroVOC Latex Eg-Shel, B20-2600 Series.

- E. Overhead Exposed Construction (Deck, Joists, Steel): One coat flat dry fallout coating system to cover formulated for compatibility with all substrates by any paint manufacturer specified in this Section. Use 100 percent acrylic, flash-rust-resistance dryfall.

1. Benjamin Moore & Co.: SK-5000 Coronado Spray Latex Flat Dry Fall 153 N110.
2. PPG Paints: Speedhide Super Tech WB Interior 100% Acrylic Dry-Fog Latex 6-724XI, 6-725XI.
3. Rust-Oleum: 5100 Series Dry Fall Acrylic Flat (Low VOC).
4. Sherwin-Williams Company: Pro Industrial Waterborne Acrylic Dryfall Flat, B42W00181.

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SECTION 099230 - SPECIAL WALL COATINGS (SWC)

PART 1 - GENERAL

1.1 SUMMARY

- A. Extent of special wall coating work is shown on drawings and schedules, and as herein specified.
- B. This Section includes surface preparation and application of special wall coating systems to items and surfaces scheduled, including surface preparation, prime coats and topcoats.
 - 1. Division 09 Section Interior or Exterior Painting• for general painting.
- C. Types of special coating systems required for the project include:
 - 1. Special Coatings for Interior Use at Doors, Door Frames, Walls and Ceilings:
 - a. Two-Component Epoxy Emulsion.
- D. Gloss ranges used in this Section include the following:
 - 1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 - 2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information including basic materials analysis and application instructions for each coating material specified.
 - 1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Samples: Provide manufacturer's standard color charts or chips for review for possible selection by the Architect.

1.3 QUALITY ASSURANCE

- A. Applicator's Qualifications: Applicator shall have been trained by the manufacturer and have had satisfactory performance record for a minimum period of the past two years in the application and use of similar products and application equipment on projects of similar magnitude. Applicator shall be able to obtain written certification of qualifications from materials manufacturer, if so requested by Architect.
- B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Name or title of material.
 - 2. Manufacturer's name, stock number and date of manufacture.
 - 3. Contents by volume, for major pigment and vehicle constituents.
 - 4. Thinning instructions.
 - 5. Application instructions.
 - 6. Color name and number.

7. Handling instructions and precautions.

B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 deg. F in a well ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary precautionary measures to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of coatings.

1.5 PROJECT CONDITIONS

A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are above 45 deg. F, unless otherwise permitted or restricted by manufacturer's printed instructions.

B. Do not apply coatings in snow, rain, fog or mist, or when the relative humidity exceeds 85 percent, or at temperatures less than 5 deg. F above the dew point, or to damp or wet surfaces unless otherwise permitted by manufacturer's printed instructions. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.

1. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and the temperature within the area can be maintained within limits specified by the manufacturer during application and drying periods.

1.6 EXTRA MATERIALS

A. Furnish extra special wall coating materials from the same production run as materials applied and in quantities indicated below. Package coating materials in unopened factory-sealed containers for storage and identify with labels describing contents.

1. Quantity: Furnish 2 gallons of each color applied. Furnish both components in quantity indicated for epoxy paints.

PART 2 - PRODUCTS

2.1 INTERIOR COATING MATERIALS

A. Base or Prime Coats: Provide the manufacturer's recommended factory formulated base or prime coat materials compatible with substrate and finish coat material indicated.

B. Block Fillers: Provide the manufacturer's recommended factory formulated heavy duty block filler or epoxy emulsion under two component epoxy emulsion coatings on concrete unit masonry.

C. Products: Subject to compliance with requirements, provide one of the products indicated.

D. Manufacturer's Names: The following manufacturers are referred to in the coating system descriptions by shortened versions of their names shown in parenthesis:

1. Benjamin Moore & Co. (Moore).
2. PPG Paints (PPG).
3. Rust-Oleum (RO).
4. Sherwin-Williams (SW).
5. Tnemec Company, Inc. (Tnemec).

E. Dry Areas: Two component, low odor, high solids, water-reducible acrylic epoxy emulsion over ferrous metal, concrete block, masonry and gypsum drywall.

1. Moore: Series M44 Acrylic Epoxy Coating Semi-Gloss.
 2. PPG: 16-551/16-599 Pitt-glaze WB Acrylic Epoxy Semi-Gloss.
 3. RO: 5300 Series WB Catalyzed Epoxy.
 4. SW: Water Based Catalyzed Epoxy, B67 Series B67W201.
 5. Tnemec: Series 114 H.B. Tneme-Tufcoat.
- F. Wet Areas: Two component, low odor, high solids, water-reducible polyamide epoxy emulsion over ferrous metal, concrete block, masonry and gypsum drywall.
1. Moore: Series Epoxy Coating Semi-Gloss.
 2. PPG: 98-1/98-100 Aquapon WB Water Based Polyamide Epoxy Semi-Gloss .
 3. RO: 5300 Series WB Catalyzed Epoxy
 4. SW: Water Based Catalyzed Epoxy, B70 Series B60V25.
 5. Tnemec: Enviro-pox 287

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which coating will be performed for compliance with requirements for application of coatings. Do not proceed with application until unsatisfactory conditions have been corrected.
- B. Start of coating work will be construed as the Applicator's acceptance of surfaces within particular area.

3.2 PREPARATION

- A. General: Remove hardware, hardware accessories, plates, machined surfaces, light fixtures, and similar items which are not to be coated, or provide surface-applied protection prior to surface preparation and coating. Remove these items if necessary for complete coating of the items and adjacent surfaces. Following completion of coating operations in each space or area, reinstall items removed, using workmen skilled in the trades involved.
- B. Clean surfaces before applying coatings or surface treatments. Schedule cleaning and coating application so dust and other contaminates will not fall on wet, newly coated surfaces.
- C. Surface Preparation: Perform surface preparation and cleaning in compliance with the manufacturer's instructions for the particular substrate conditions, and as specified.
 1. Notify the Architect in writing of anticipated problems using coatings specified with substrates primed or furnished by others.
- D. Ferrous Metal Surfaces: Clean non-galvanized, ferrous metal surfaces; remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with the recommendations of the Steel Structures Painting Council.
 1. Verify compatibility of shop primer materials. If acceptable, in accordance with finish system, manufacturer's recommendations, touch-up shop applied prime coats which have been damaged, and bare areas. Wire-brush, solvent clean, and touch-up with the same primer as the shop coat. If shop coat is not acceptable remove primer to bare metal and refinish with acceptable materials.
- E. Gypsum Drywall Surfaces: Remove raised paper surfaces and fill minor irregularities, scratches, cuts, etc., with acceptable patching material. Lighting sand filled areas flush so as not to raise nap of paper surfaces.
- F. Material Preparation: Carefully mix and prepare materials in compliance with the coating manufacturer's directions.

1. Stir materials before application to produce a mixture of uniform density, and as required during application. Do not stir film, which may form on surfaces, into the material. Remove film and, if necessary, strain the coating material before using.

3.3 APPLICATION

- A. Apply special coatings by brush, roller, spray, or other applicators in accordance with manufacturer's directions. Use brushes best suited for the material being applied. Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 1. Coating types and colors are indicated in the "Room Finish" and "Color Schedules" of the contract documents.
 2. Provide finish coats compatible with the primers used.
 3. Materials shall be uniformly applied and shall be free from sags, skips, runs and other defects.
- B. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
- C. Minimum Coating Thickness: Apply each material at not thinner than the manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by the manufacturer.
- D. Prime Coats: Before application of finish coats, apply a prime coat and/or base as recommended by the manufacturer, to material required to be coated or finished, and which has not been prime coated by others.
 1. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in the first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- E. Brush Application: Wherever brush application is recommended, brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
- F. Mechanical Applications: Use mechanical methods for coating application when permitted by the manufacturer's recommendations, governing ordinances, and trade union regulations.
 1. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of 2 coats in one pass, unless recommended by the manufacturer.
- G. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or recoat work not in compliance with specified requirements.

3.4 CLEANING

- A. Clean-Up: At the end of each work day, remove rubbish, empty cans, rags and other discarded materials from the site.
 1. Upon completion of work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping or other proper methods, using care not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

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- A. Protect work of other trades, whether to be coated or not, against damage from coating. Correct damage by cleaning, repairing, replacing, and recoating as acceptable to the Architect. Leave in an undamaged condition.
- B. Provide "Wet Paint" signs to protect newly-coated finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of coating operations.
 - 1. At completion of construction activities of other trades, touch-up and restore damaged or defaced coated surfaces.

3.6 INTERIOR SPECIAL COATING SCHEDULE

- A. Provide the following coating systems for substrates indicated:
 - 1. Apply additional coats when undercoats or other conditions show through final coat, until the cured film is of uniform coating finish, color and appearance.
- B. Ferrous Metals:
 - 1. Primer: Manufacturer's recommended primer, if shop primed, verify compatibility with finish coat(s).
 - 2. First Coat: Two Component Epoxy Emulsion, Semi-Gloss.
 - 3. Second Coat: Two Component Epoxy Emulsion, Semi-Gloss.
- C. Concrete Block Masonry:
 - 1. First Coat: Heavy duty block filler.
 - 2. Second Coat: Two-Component Epoxy Emulsion, Semi-Gloss.
 - 3. Third Coat: Two-Component Epoxy Emulsion, Semi-Gloss.
- D. Gypsum Drywall:
 - 1. First Coat: Manufacturers recommended primer.
 - 2. Second Coat: Two-Component Epoxy Emulsion, Semi-Gloss.
 - 3. Third Coat: Two-Component Epoxy Emulsion, Semi-Gloss.

END OF SECTION 099230

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SECTION 099714 - THERMAL-BREAK COATING FOR STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification covers in accordance with all applicable requirements of contract documents.
- B. Section Includes
 - 1. Labor, materials, equipment, and application necessary for, and incidental to, complete and proper application of liquid-applied thermal break acrylic to steel structures and supports, including, but not limited to:
 - a. Corrosion protection primer material.
 - b. Liquid Applied Thermal Break Acrylic.
 - c. Topcoat for Liquid Applied Thermal Break Acrylic

1.2 ACTION SUBMITTALS

- A. Product Data: Product data including manufacturer's technical data indicating product performance characteristics, performance and limitation criteria.
 - 1. Include published design listings for insulation value ratings and product thickness, including evidence that thermal-break coating testing was sponsored by manufacturer and that material tested was produced at manufacturer's facility under supervision of technical personnel.
 - 2. Include manufacturer's documentation that thermal-break coating complies with specified requirements

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Instructions: Submit manufacturer written application instructions.
- B. Applicator Qualifications: Submit applicator's current certification as manufacturer-trained applicator.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing thermal-break coating for steel with minimum of 2 years documented experience in manufacturing insulative technology.
- B. Applicator Qualifications: Company specializing in applying thermal-break coating with documented experience and certified and trained by thermal-break coating manufacturer.
- C. Mock-up: Not more than thirty days prior to thermal-break coating application in any area, provide mock-up samples of thermal-break coating as follows:
 - 1. Provide minimum two square feet on representative substrate, where directed by Architect, for each different desired R-value and finish required.
 - 2. Provide mock-up areas complying with thickness, density application, finish texture, and color.
 - 3. Inspect mock-up areas within one hour of application for variance due to shrinkage, temperature, and humidity.
 - 4. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary to comply with installation, R-value, finish, and color requirements.
 - 5. Continue to provide mock-up areas until acceptable areas are produced.
 - 6. Acceptable areas constitute standard of acceptance for method of application, thickness, finish texture, and color requirements, for thermal-break coating application.

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1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, sealed, undamaged container with identification label intact. Provide appropriate labels and seals on packaged materials.
- B. Storage: Store materials in strict accordance with manufacturer's documented instructions.
- C. Documentation: Record on quality control documents all batch numbers, product identification and quantities and attach copy of transport document and manufacturer's conformance certificate to material delivered on Site.

1.6 PROJECT/SITE CONDITIONS

- A. Ambient Conditions: Comply with manufacturer's requirements for substrate and air temperature. Protect work area from windblown dust and rain and protect adjacent areas from over spray of material. Provide ventilation in areas to receive thermal-break coating during application and minimum 24 hours after application.
 - 1. Temperature and Humidity Requirements: Maintain air temperature and relative humidity in areas where thermal-break coating will be applied for time period before, during, and after application as recommended by thermal-break coating manufacturer.
 - a. Do not apply thermal-break coating when temperature of substrate and/or surrounding ambient air temperature is below 45 deg. F. Provide and maintain temporary protection and vented heat at this minimum temperature for 24 hours before, during, and 24 hours after thermal-break coating application.
 - b. Ensure steel substrate temperature is minimum of 5 deg. F above dew point of surrounding air for 24 hours prior and during thermal-break coating application.
 - c. If necessary, coordinate providing enclosures and heat to maintain proper temperatures and humidity levels in application areas.
 - d. Do not exceed 85 percent relative humidity of application area for 24 hours prior, during, and 24 hours after thermal-break coating application. Do not exceed 75 percent relative humidity throughout thermal-break coating application and drying of the decorative top coat finish.

PART 2 - PRODUCTS

2.1 LIQUID APPLIED THERMAL BREAK ACRYLIC COATING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated below by Tnemec Company, Inc. or comparable product approved by the Architect.
 - 1. Sole Source: Provide complete system from sole source consisting of primer, acrylic thermal break material, and topcoat.
- B. Performance Criteria
 - 1. Complete System:
 - a. ASTM E 84: Class A
 - b. ASTM D 5894: 5,000 hrs Prohesion (Topcoated)
 - c. ASTM B 117: 5,000 hrs. Salt Fog (Topcoated)
 - d. ASTM D 870: 6 months Immersion in tap water (Topcoated)
 - e. ASTM D 4585: 2,000 hrs. Humidity (Topcoated)
 - f. ASTM D870 Method B: 2,000 hrs. 140F DI Water Immersion (Topcoated)
 - g. ASTM D 4060 (CS-17 Wheel, 1,000g load): No more than 50.2 mg loss after 1,000 cycles.
 - h. ASTM C518 Thermal Conductivity: Not greater than 0.2468 BTU-in/ft²-hr-deg.F.

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- i. ASTM D1653 Method B Wet Cup: No more than 23.91 g/sq.m per 24 hour water vapor transmission and no more than 1.71 perms (1.13 metric perms water vapor permeance).
- 2. System Thickness / R-Value:
 - a. 1/32 inch thick: R-0.10.
 - b. 1/16-inch thick: R-0.25.
 - c. 1/8-inch thick: R-0.5.
 - d. 1/4-inch thick: R-1.
 - e. 3/8-inch thick: R-1.5
 - f. 1/2-inch thick: R-2.
 - g. 5/8-inch thick: R-2.5.
 - h. 3/4-inch thick: R-3.
 - i. 7/8-inch thick: R-3.5.
 - j. 1-inch thick: R-4.0
- C. Primer - Shop Applied or Field Applied: Aromatic polyurethane, mio-zinc filled primer.
 - 1. Basis-of-Design Product Tnemec Series 394 Perimiprime.
 - 2. Properties:
 - a. Solids by Volume: 61 percent mixed.
 - b. Recommended Film Thickness: 2.5 to 3.5 mils dry film thickness (DFT).
 - c. VOC Content: 2.05 lbs. per gallon
 - d. Curing Time at 75 degrees F: 15 minutes to touch, 16 hours to recoat
 - e. Net Weight per Gallon: 21.36 lbs.
 - f. Pot Life at 77 degrees F and 50 percent R.H.: 24 hours
 - g. UL classified in accordance with UL 263 (ASTM E119), meeting material adhesion test ASTM E736 under various fire resistive products.
 - h. Meets AISC requirements in accordance with RCSC Appendix A for Class B surface with mean slip coefficient no less than 0.50 and tension creep not in excess of 0.005 inches.
- D. Thermal Break Material - Shop Applied or Field Applied: Aerolon acrylic coating.
 - 1. Basis-of-Design Product: Tnemec Series 971 Aerolon Acrylic.
 - 2. Properties:
 - a. Solids by Volume: 76 percent.
 - b. Recommended Film Thickness: 40 to 300 mils dry film thickness (DFT) applied in multiple applications to specified R-value.
 - c. VOC Content: 0.01 lbs. per Gallon.
 - d. VOC Thinned: 0.01 lbs. per gallon.
 - e. Curing Time at 75 deg. F: 4 hours to touch , 16 hours to recoat
 - f. Thermal Conductivity, ASTM C 518: No more than 35.6 mW/ mK
 - g. Net Weight per Gallon: 4.66 lbs. per gallon.
 - h. Storage Temperature: 40 deg. F.; maximum 110 deg. F..
 - i. Number of Components: Single component
 - j. Pot Life: 2 hours
 - k. Spray Life: 2 hours

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions

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1. Verify all surfaces receive thermal-break coating are clean, dry and free of oil, grease, loose mill scale, dirt, dust or other foreign substances which would impair bond of coating to substrate.
2. Verify substrate and workspace temperature and humidity conditions are in accordance with manufacturer's recommendations.
3. Start of application of thermal-break coating indicates surfaces are acceptable to receive primer and thermal-break material.

3.2 PREPARATION

- A. Provide masking, drop cloths or other suitable coverings to prevent overspray onto surfaces not intended to be coated with thermal-break coating.
- B. In accordance with coating manufacturer's recommendations and instructions, clean steel substrate free from dust, dirt, grease, paint or other foreign substances that would impair with bond of thermal-break coating.
- C. Grind smooth weld spatter and defects prior to commencement of surface preparation.
- D. Do not apply primer to prepared substrate until area has been adequately vented to remove all airborne dust. Prior to application of any coating material, remove blast products, dust and debris.

3.3 APPLICATION

- A. Apply thermal-break coating in accordance with manufacturer's application instructions at indicated dry film thickness (DFT).
- B. Do not spray steel deck unless otherwise indicated. All other thermal break locations as indicated on the contract documents shall be coated to achieve an R value of .25 (90-100 mils DFT of Series 971 Aerolon). At each location, apply thermal-break coating system to cover steel beams 18-24 inches inside wall system, through width of wall system, and 18-24 inches outboard of wall system. Seal all penetrations as recommended by coating manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage services of qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEAN UP AND REPAIR

- A. Upon completion of installation, clear all excess material, overspray and debris and remove from Site.
- B. Remove overspray materials from surfaces not indicated to be coated.

END OF SECTION 099714

SECTION 099737 - DRY ERASE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Field-applied dry erase coatings.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Maintenance Instructions: Provide precautions against cleaning materials and methods that may be detrimental to finish and performance.
- B. Samples: Submit verification sample of specified color on manufacturer's standard sample card.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 3 years manufacturing dry erase coatings.
- B. Mock-ups: Prepare mock-ups for Architect's review and to establish requirements for substrate finish and final coating application, texture and color.
 - 1. Install dry erase coatings mock-up in area designated by Architect.
 - 2. Correct areas, modify method of application/installation, or adjust finish texture as directed by Architect to comply with specified requirements.
 - 3. Maintain mock-ups accessible to serve as standard of quality for this Section.
 - 4. Accepted mock-ups may remain in place.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original factory wrappings and containers, clearly labeled with manufacturer, product name, and fire hazard classification.
- B. Store materials in original undamaged packages and containers inside a well -ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity. Store at temperatures above 40 degrees F. Do not allow product to freeze.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperature not less than 50 deg F minimum and 85 deg F maximum 72 hours prior to beginning of installation.
 - 1. Do not install dry erase coatings unless substrate temperature is above 60 degrees F.
 - 2. Do not install dry erase coatings until the space is enclosed and weatherproof.
 - 3. Do not install dry erase coatings until temperature is stabilized and permanent lighting is in place.

1.6 WARRANTY

- A. Warranty: Manufacturer's 10 year limited material warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in Finish Legend on Drawings or acceptable comparable product approved by the Architect.

2.2 DRY ERASE COATING

- A. Coating: Two-component non-isocyanate based coating providing surface suitable for use with dry erase markers.
 - 1. Color: As indicated in Finish Legend on Drawings.
 - 2. Fire Rating (ASTM E84): Class A.
 - 3. Finish/Gloss (ASTM D523) on Dry Gypsum Board:
 - a. 60 degrees: 92.0.
 - 4. Scrub Resistance (ASTM D2486): Greater than 10,000 cycles.
- B. Primer: High quality primer acceptable to dry erase coating manufacturer for substrates indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions in which dry erase coatings will be installed.
 - 1. Complete finishing operations, including painting, before beginning installation of dry erase coatings.
 - 2. Wall surfaces to receive dry erase coatings shall be dry and free from dirt, grease, loose paint, and scale.
 - 3. Do not proceed with installations until unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Remove hardware, accessories, plates and similar items to allow dry erase coatings to be installed.
- B. Repair damaged areas by filling voids with spackle. Sand smooth repaired or textured surfaces. Scuff glossy and non-porous surfaces using medium grit sandpaper. Paint product is a high gloss coating; imperfections and visible seams will telegraph.
- C. Gypsum Board Surface: Provide Level 4 finish per ASTM C840 and GA-214. Recess nails and screws. Repair irregular tape joints, sand and remove dust.
- D. Prime: Prime substrate using materials recommended by manufacturer if changing color of the surface, if covering a stained surface, or if applying on new drywall. Follow manufacturer's application, dry time, and recoat instructions prior to proceeding.
 - 1. Changing color of the surface: Prime surface until the color of the existing surface does not show through.
 - 2. Covering stained surface: Prime surface until undesired marks and stains do not show through.
- E. Clean: Wipe surface with a clean, damp cloth to remove dust and environmental debris. Allow surface to completely dry.
- F. Ventilate area thoroughly to aid in curing process and to dissipate mild odor. Allow a high percentage of outside air into current ventilation.

3.3 APPLICATION

- A. Comply with manufacturers printed installation instructions. Mix components in strict accordance with manufacturer's instructions. Pot life is 1 hour maximum.
- B. Apply dry erase coating with specified roller only. Comply with the following:
 - 1. Apply heavy single coat only, using 2 layer method as described. Do not recoat or touch up applied coating once 10 minute return time has passed.
 - 2. Divide entire surface into areas up to 50 square feet.
 - 3. Be sure to overlap edges of each section and use backrolling technique to even out application.
 - 4. Watch for roller marks, drip marks, debris and missed spots, re-roll as needed.
 - 5.
 - 6. Remove masking tape within 1 hour of painting.
- C. Dry erase coating may be applied directly onto following clean, dry, smooth surfaces:
 - 1. Finished drywall surface,
 - 2. Latex-based topcoat,
- D. Allow coating to cure for minimum 4 days after application before use.

3.4 CLEANING AND MAINTENANCE

- A. Cleaning with standard dry erase eraser or dry microfiber towel or thorough cleaning with damp microfiber towel or coating manufacturer's recommended cleaner. If damaged, degloss original surface by sanding surface and priming before recoating.

3.5 PROTECTION

- A. Protect installed product and finished surfaces from damage during construction in accordance with coating manufacturer's recommendations.

END OF SECTION 099737

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SECTION 101146 - VISUAL DISPLAY FABRICS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes dry-erase wall coverings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of dry-erase wall covering. Include data on physical characteristics, durability, and flame-resistance characteristics.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
- C. Shop Drawings: Show location and extent. Indicate seams and termination points.
- D. Samples: Full width by 36-inch- long section of dry-erase wall covering.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For dry-erase wall coverings to include in maintenance manuals.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install dry-erase wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Lighting: Do not install dry-erase wall covering until a permanent level of lighting is provided on the surfaces to receive dry-erase wall covering.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.

2.2 DRY-ERASE WALL COVERINGS

- A. Dry-Erase Wall Covering: Intended for use with dry-erase markers and as a projection surface and consisting of moderate-gloss plastic film bonded to fabric backing.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Walltalkers; ~~Project Rite PE50-00 NU-VU-RITE~~ or comparable product approved by the Architect.
(ADD 3-1)
 - 2. Color: White.

2.3 ACCESSORIES

- A. Adhesives for Field Application: Strippable, mildew-resistant, nonstaining adhesive for use with dry-erase wall coverings; and for substrate application; as recommended in writing by dry-erase wall covering manufacturer.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
- B. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099123 "Interior Painting" and recommended in writing by dry-erase wall covering manufacturer for intended substrate.
- C. Markertray: Manufacturer's standard; continuous.
 - 1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

2.4 GENERAL FINISH REQUIREMENTS

- 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 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.

2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, moisture content, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation for dry-erase wall covering.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, including dirt, mold, and mildew, that could impair the bond of dry-erase wall coverings or affect the smooth, finished surfaces of dry-erase wall coverings.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, and depressions.
- D. Prepare substrates indicated to receive dry-erase wall covering as required by manufacturer's written instructions to achieve a smooth, dry, clean, structurally sound surface that is uniform in color.
 - 1. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.
 - 2. Metals: If not factory primed, clean and apply metal as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.

3. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
4. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
5. Painted Surfaces: Treat areas susceptible to pigment bleeding.

3.3 INSTALLATION

- A. Dry-Erase Wall Covering: Comply with dry-erase wall-covering manufacturers' written installation instructions.
 1. Install seams horizontal and level, with lowest seam 24 inches above finished floor. Railroad fabric (reverse roll direction) to ensure color matching.
 2. Double cut seams, with no gaps or overlaps. Remove air bubbles, wrinkles, blisters, and other defects.
 3. After installation, clean dry-erase wall covering according to manufacturer's written instructions. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

3.4 CLEANING AND PROTECTION

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Clean dry-erase wall covering according to manufacturer's written instructions. Attach one removable cleaning instructions label to dry-erase wall covering in each room.
- C. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 101146

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SECTION 101400 – SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes signs and graphics as detailed on drawings and specified in this section with message and images indicated in Sign Message Schedule.
- B. List of signage graphics alternatives: see section 012300 - alternates

1.2 ACTION SUBMITTALS

- A. Product data: Submit manufacturer's printed specifications, anchorage details, and installation and maintenance and images indicated in Sign Message Schedule.
- B. Shop drawings: Submit shop drawings showing graphic design requirements by details establishing basic dimension of units or modules, profiles, sight lines or members, design appearance and intent.
 - 1. Include all major aspects for proposed system, such as sections, shapes, material, and connection and anchorage to structure.
 - 2. Show joints, anchorage, accessory items, and finishes.
 - 3. Submit drawings of typical sign types.
 - 4. Artwork: Submit following drawings:
 - a. Preliminary submittal.
 - b. Final submittal prior to fabrication.
 - c. Copy and message verification prior to production.
 - 5. Silk Screen Inks: Submit full size drawings of foundry to be provided.
- C. Samples
 - 1. Submit up to three rounds of 6-inch by 6-inch samples of each color and finish of exposed materials and accessories, and of final material substrate to be use in project. Samples used for final color selection.
 - 2. Submit samples as indicated under the materials section for each sign type in document.
 - 3. For all clear polyester film, first round of sample submittals to be manufacturer's standard frost and color print designation sheets. (Outside of 6" x 6" requirement)

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance and service manuals: provide maintenance and service manuals for all typical signs, hardware, and other related materials.

1.4 QUALITY ASSURANCE

- A. Pre-installation conference: after award of contract conduct a pre-installation conference on site with representatives from the general contractor, signage fabricator, owner, architect, and environmental graphics designers. Review methods and procedures for installing environmental graphics including, but not limited to the following:
 - 1. Coordinate installation locations and required blocking, electrical, etc.
 - 2. Fasteners
 - 3. Required Submittals
 - 4. Required Shop Drawings
 - 5. Required Mock-ups
 - 6. Project Schedule

- B. Mock-up: furnish full size mock-ups of each sign type showing all characteristics of sign materials, colors, and structure and deliver to location selected by owner. Approved mock-up is standard for project. Approved full sign/component mock-ups finished per specifications can be used for project upon architect coordination/support.

1. Required mock-ups include the following:

- a. All color samples (paint, vinyl, and silkscreen ink).
- b. Up to 3 rounds of color samples of custom printed translucent white on optically clear polyester film for color evaluation on large format custom printed graphics on glass per the following locations: [EG-02]. (Use 3' x 3' section containing full-scale art for samples as directed by architect.)
- c. Up to 3 rounds of color samples of custom printed translucent white on optically clear polyester film for color evaluation on large format custom printed graphics on glass per the following locations: [EG-03]. (Use 3' x 3' section containing full-scale art for samples as directed by architect.)
- d. EG-01 furnish up to 3 rounds of samples of a section that shows finish, specified color, 3/32" reveal and metal (Satin Muntz) detail.
- e. Furnish one full-size Photocast ADA IDI-01 sign for reversed-etched method and painted metal quality approval. Finished one full-size Photocast ADA IDI-01 sign for reversed-etched method and painted metal quality approval. Finished per specifications as directed by architect.
- f. Furnish one full-size ADA IDI-03 sign on project glass 12" x 12" sample for approval. Finished per specifications as directed by architect. Will be used for approval with EG-02 and EG-03 film.
- g. DI-01, DI-02, and DI-04 directional identification: furnish full-size rift sawn white oak sample for, mitered edge detail, mounting method, paint, silkscreen and vinyl quality approval. Finished per specifications as directed by architect.
- h. DI-03 directional identification: furnish full-size rift sawn white oak sample for, mitered edge detail, mounting method, paint, silkscreen, and vinyl quality approval. Finished per specifications as directed by architect.
- i. IDI-03 Directional blade sign: furnish full-size painted MDF blade sign detail, mounting method, paint, silkscreen and vinyl quality approval. Finished per specifications as directed by architect.
- j. Furnish one full-size ADA IDE-01 letter; all edges finished.

1.5 DESIGN ASSIST SCOPE FOR WORK

- A. Where noted as "Design Assist" the scope of work includes working as a team member to assist the architect and their graphic design consultant, Kuhlmann Leavitt, Inc. with development of the sign elements noted in addition to providing and installing the signs.
- B. Where noted as "Design Assist" the documents have been developed to outline the requirements and design intent but require the assistance of the fabricator to complete the design of the work meeting the full intent of the design.

PART 2 - PRODUCTS

2.1 PHOTOCAST ADA SIGNAGE

- A. Where Basis-of-design products: subject to compliance with requirements, provide products by Braille-Tac-Podcast (etched zinc) or acceptable comparable product:
 1. Coordinate Advance Corporation, Braille-TacTM Division, 8200 – 97th Street South, Cottage Grove, Minnesota, 55016, 800-328-9451

2. Other manufacturers seeking approval of their products must comply with requirements of the instructions to bidders (AIA document A701), paragraph 3.3 prior to bidding.

B. Sign type

1. Coordinate IDI-01, IDI-02, IDI-03 and IDI-04 all levels, Braille-Tac™ one-piece construction custom sign system utilizing chemical etch process to produce raised numbers and letters with corresponding Grade II Braille (complying with specification #800), on zinc sign, all complying ADA and CABO/ANSI A117.1 requirements.

C. Material: zinc reverse etched with custom painted surface and edges; custom color in Matthews Paint or acceptable comparable product; colors vary by sign type per message schedule wall color designations.

D. Description: Vertical face ADA panels, attached with no visible hardware as detailed on drawings

1. Coordinate Thickness: final zinc thickness after reverse-etch is .098-inch panels; size and shape as shown in drawings.
2. Panels cut to size and shape by manufacturer as shown on drawings.
3. Panels may be direct glued to acrylic spacer on wall surface primed in accordance with sign manufacturer's requirements.
4. Panels: mount as shown on drawings and in accordance with fabricator's recommendations.

E. Finishing:

1. Coordinate Panel edges: smooth, free of blemishes. Edge to receive Matthews Sign paint as shown on drawings.
2. Panels may be direct glued to acrylic spacer on wall surface primed in accordance with sign manufacturer's requirements. Raised letters: precisely formed characters with edges free from burrs or cut marks. Chemical etch process to produce raised numbers and letters with corresponding Grade II Braille. Comply with requirements for raised copy thickness.

2.2 ACYRLIC ADA SIGNAGE

A. Basis-of-design products: subject to compliance with requirements, provide products by Rowmark acrylic or acceptable comparable product approved by architect:

1. Rowmark LLC, Industrial Dr., Tall Timber Industrial Park, Findlay, OH 45840, 877-769-6275.

B. Sign type

1. IDI-06 ADA Room ID Back-Of-House signage: single ply modified acrylic for use on interior signage; color as selected by architect; matte non-glare finish; 1/8 inch thick panel with 1/32-inch thick raised acrylic letters and clear raster braille.

C. Finishing:

1. Panel edges: smooth, free of blemishes, corner condition square or slight radius for safety.
2. Raised letters: precisely formed characters with square cut edges free from burrs or cut marks. Comply with requirements for raised copy thickness.

2.3 SILK SCREEN INKS

A. Basis-of-design product: subject to compliance with requirements, provide products by one of the following or acceptable comparable product:

1. Naz-Dar Company
 2. Wornow Products Department, Dexter Corp. Industry
 3. Colonial Printing Ink Co.
- B. All screen printing executed from photo screens prepared for reproductions of specified copy. Hand-cut screens not acceptable.
- C. Execute screen printing in manner that all edges and corners of finished letterforms and graphic devices are true and clean. Letterforms with rounded positive or negative corners, edge build-up or bleeding, etc. not acceptable.
- D. Provide inks, paints and lacquers required for silk-screened or imprinted surfaces or other specified surfaces made for surface material on which it is to be applied and recommended by ink or paint manufacturer.
- E. Provide silk-screen inks made by manufacturer with experience in production and consistency of such inks for purposes and surfaces involved.
- F. Do not use paint, ink or lacquer that will fade, discolor or delaminate as result of proximity to UV light source or heat.
- G. Evenly apply inks, paints and lacquers without pinholes, scratches, orange peeling, application marks, etc. Rear-illuminated panels containing defects specified above or other defects, which cause light leaks in surface areas not acceptable.
- H. Provide prime coats or other surface pre-treatment, where recommended by ink, paint or lacquer manufacturer.

2.4 ACRYLIC POLYURETHANE PAINT

- A. Basis-of-design product: subject to compliance with requirements, provide products by the following or acceptable comparable product:
1. Coordinate Matthews Paint Company, Matthews Paint 770 Pittsburgh Drive, Delaware, OH 43015
- B. All signs specified as painted metal to receive a Satin VOC MAP® Low VOC Satin Acrylic Polyurethane Topcoat with custom Matthews paint color to match graphics colors as specified in drawings. Architect to provide custom MP product numbers for custom colors to prior to submittal process.
- C. All painted metal and exposed metal to be finished with VOC Satin Clear 281 228SP acrylic polyurethane with a natural satin finish for added protection and durability.

2.5 VINYL LETTERFORMS AND GRAPHICS

- A. General
1. This article defines basic materials and fabrication methods for markings to be used for cut out designs. Do not deviate from specified requirements without written approval of architect.
 2. Provide certification from marking manufacturer that all markings conform to specified requirements and will be replaced or repaired without cost to owner if found to not comply with specified requirements.
 3. Provide access to marking manufacturer's facilities for architect to owner, excluding areas or processes proprietary to manufacturer to allow inspection of markings to be provided for this project.
 4. Provide pressure sensitive cut vinyl, pre-spaced and pre-aligned on transfer paper. Provide vinyl graphics in colors and type styles indicated.
 5. Provide graphics that are weather-resistant and not affected by oil, water, salt spray, or alcohol.

6. Where indicated as installed on 2nd surface provide reverse cut copy for application to glass; otherwise provide correct reading on glass.
- B. Material: vinyl in color and translucency specified.
 1. Basis-of-design product: subject to compliance with requirements, provide the following products or acceptable comparable product:
 - a. 3M Brand Graphic Film, Series 7725 Premium Cast Films, warranty for exterior application
 - b. 3M Brand Graphic Film, Series 3630 Premium Translucent Films, warranty for exterior application
- C. Fabrication: fabricate marking in size, color and shape indicated and complying with manufacturer's published requirements.

2.6 CLEAR UV POLYESTER FILM

- A. Basis-of-design product: subject to compliance with requirements, provide SOLYX Decorative Privacy by Decorative Films, LLC or acceptable comparable product.
- B. Description: durable optically clear polyester film with printed patterns in clear frosted ink with added UV protection and scratch resistant over laminate coating to protect inks. Film 100 percent UV-stabilized and will not alter in color and inks will not fade or change color. Film provides 99 percent UV block. Provide frost variations as selected from manufacturer's standard frost print designation sheet.
 1. Nominal thickness: 2 mil

2.7 FABRICATION

- A. Verify location of each specific sign and take field measurements prior to preparation of shop drawings and fabrication. Allow for trimming and fitting wherever field measurements cannot be taken prior to fabrication.
- B. Accurately fabricate signs to shape and dimension in strict accordance with approved shop drawings.
 1. Accurately reproduce letters, symbols and rules as indicated in drawings.
- C. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly.
 1. Disassemble units as necessary for shipping and handling limitation. Clearly mark units for reassembly
- D. Ensure that all assemblies, components and parts shown or required comply with contract documents, including:
 1. That all components, specified or required to satisfactorily complete installation, are compatible with each other and with conditions of installation and expected use.
 2. Overall effective integration and correctness of individual parts and whole of system.
 3. Compatibility with adjoining substrate, materials and construction.
- E. Separate dissimilar metals with gaskets or by other industry standard methods to ensure against corrode. Provide separating materials that are stable within minimum 65 degrees C temperature differential, and not impacting on appearance of signs.
- F. Dimensional and flatness tolerance

1. Provide all signs uniform in size and thickness within standard commercial tolerances. Provide size of signs as indicated on drawings
 2. Ensure all signs are of thickness required for proper strength and stability. Locate internal structural ribbing as required to prevent warping and cupping of sign faces. Do not use cardboard, or other material capable of being warped by dampness. Ensure sign face is free of waves, buckles and warps. Design and detail anchorages, connections and joints to allow for expansion and contraction over temperature range for material of 65 degrees C, without buckling sealant joint failure, glass breakage, undue stress on members or anchors, and other detrimental effects.
- G. Letters, numbers, symbols, icons
1. Verify with owner any revisions to signage message schedule prior to fabrication.
 2. Provide signs with lettering and symbols shown on drawings and in message schedule for locations as indicated on drawings. Provide all camera ready art required to fabricate lettering and symbols.
 3. Provide capital height of letter size and symbol as indicated on drawings.
 4. Unless otherwise indicated on drawings, provide letter spacing of optical spacing 20/1000 em with spacing between words equal to horizontal dimension of lower-case "m" for size of copy used. Submit full-size spacing pattern for each typical message specified to owner and architect for approval. Do not execute spacing patterns not approved by owner.
 5. Where indicated on drawings and other documents, provide specific signs with tactile characters, raised-line symbols, and/or Grade 2 Braille complying with The Americans with Disabilities Act Accessibility Guidelines (ADAAG). Section 4.30, Signage.
- H. Braille: Grade 2 Braille
1. Fabricator responsible for all braille translations and for proofreading of output braille before installation of signs.
 2. Provide all signs braille translations in upper and lowercase. Do not set braille in all uppercase.
- I. Tactile letters, symbols, pictograms, and artwork
1. Provide items that tactile raised .8 mm (1/32 inch) from plaque surface with letters in uppercase and at least 16 mm (5/8 inch) high, accompanied by Grade 2 Braille.
 2. Provide tactile symbols accompanied by equivalent verbal description placed directly below. Provide tactile symbols on field that is at least 152 mm (6 inches) in height.
- J. Typefaces: Provide typefaces as indicated in construction documents under typography page.
- K. NFPA 170: comply with requirements in NFPA 170 publication 'Standard for Fire Safety Symbols' for fire symbols and required colors as well as specific sign messages required. Confirm and coordinate NFPA 170 requirements with architect.
- L. Color coating: provide color coatings for all sign, letters, and symbols as shown on drawings, in this section and on approved samples. Provide color coatings that are colorfast and nonfading when exposed to water, weather, and other environmental variations.
- M. Illumination: provide electrical lighting, LEDs, and power devices contained within or upon signage devices which are usually included are part of the illumination system of that device such as lamps, sockets, internal wiring, etc. as specified in drawings. Provide electrical connection of signage items.
- N. Anchoring devices: provide channels, plates, angles, bolts, dowels, and other anchoring devices of types and sizes shown or approved shop drawings and engineered and provided by signage fabricator. Coordinate with architect with regard to architectural preservation requirements of building.

1. Cut/drill holes for all bolts, dowels, and other anchoring devices as indicated on approved shop drawings.
2. Furnish inserts and anchoring devices, which must be set in concrete or built into other materials for installation of signage. Provide settings drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delays.

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 signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: install signs using mounting methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 4. Corrosion protection: coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
 5. Fasteners: use countersunk fasteners. No exposed fasteners.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs and graphics that do not comply with specified requirements. Replace signs 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 and graphics 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 101400

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SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments configured as toilet enclosures.

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. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

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- square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents and source.

1. Door Hinges: One hinge(s) with associated fasteners.
2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
3. Door Bumper: One bumper(s) with associated fasteners.
4. Door Pull: One door pull(s) with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

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. 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: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. 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 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Accurate Partitions Corporation.
 - 2. Bradley Corporation; Mills Partitions.
 - 3. Global Steel Products Corp.
- B. Toilet-Enclosure Style: Overhead braced Floor anchored .
- C. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
 - 1. Heat-Sink Strip: Manufacturer's standard continuous, stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
 - 2. Color and Pattern: Two colors and patterns in each room as selected by Architect from manufacturer's full range.
- D. Pilaster Shoes: Manufacturer's standard design; stainless steel.
- E. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
 - 1. Hinges: Manufacturer's minimum 0.062-inch- thick stainless-steel 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. Mount with through-bolts.
 - 2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
 - 3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
 - 4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
 - 5. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

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- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. 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. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.

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- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113.19

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Custodial accessories.
- B. Related Requirements:
 - 1. Section 088300 "Mirrors" for frameless mirrors.

1.2 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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- B. Basis-of-Design Product: Subject to compliance with requirements, provide products listed below or comparable product by one of the following:
 - 1. American Specialties, Inc.; ASI Group.
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Bradley Corporation.
 - 4. GAMCO Specialty Accessories; a division of Bobrick.

2.2 PRODUCTS

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. TA-01: Grab bar set for use at water closet; one – 36 inch long; one – 42 inch long; one – 18 inch long vertical; Bobrick B-5806 series.
- C. TA-02: Toilet paper dispenser; Bobrick B-2888.
- D. TA-03: Napkin disposal; Bobrick B-254.
- E. TA-04: Door hook; Bobrick B-6717.
- F. TA-05: Electric hand dryer; Excel Xcelerator with noise reduction nozzle; brushed stainless steel finish; XL-SB-1.IN-20B.
- G. TA-06: Soap dispenser; OFOI.
- H. TA-07: Recessed waste disposal; TS275 / B279 / B3644.
- I. TA-08: Mop rack and shelf; Bobrick B-239-34.
- J. TA-09: Napkin dispenser; Bobrick B-2706.
- K. TA-10: Diaper changing station (recessed); KB110 SSRE.
- L. TA-11: Paper towel dispenser; Bobrick B-2621.

2.3 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. 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.
- D. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- E. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

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SECTION 104313 - DEFIBRILLATOR CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Automated external defibrillator (AED) cabinet.
 - 2. Defibrillator.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For AED cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
- D. Product Schedule: For AED cabinets, and AED devices. Coordinate final AED cabinet schedule with AED schedule to ensure proper fit and function. Use same designations indicated on Drawings

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For AED cabinets, and AED devices to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Rated, AED Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate sizes and locations of AED cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).Stainless-Steel Sheet: ASTM A 666, Type 304.

2.2 AUTOMATED EXTERNAL DEFIBRILLATOR (AED) CABINET

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Cardiac Science; model 50-00395-030.
- B. Cabinet Style: Semi-Recessed.
- C. Components:
 - 1. Tub: Cold-rolled steel.
 - a. Interior Dimensions:

- 1) Width: 14.25 inches.
 - 2) Height: 14.25 inches.
 - 3) Depth: 7 inches.
 - b. Protrusion from wall: 3-1/8 inches.
 - c. Finish: Factory applied powder coat paint finish.
 - 1) Color: White.
2. Door and Trim Construction: Cold-rolled steel; flush doors with 5/8 inch (15.88 mm) door stop attached by continuous hinge and equipped with zinc-plated with roller catch.
 - a. Finish: Factory applied powder coat paint finish.
 - 1) Color: White.
 - b. Door Style:
 - 1) Full acrylic glazing; pull and AED graphics.
3. Alarms: 85 db Commander (audible) cabinet-mounted alarm standard (battery operated) to protect against theft or tampering. Alarm deactivated when door is closed.
4. Strobe: Wall mounted "satellite" type strobe mounted directly above cabinet.
5. Cabinet Lettering: Provide manufacturer's standard sign with "AED" and the universal symbol for cardiac devices.

2.3 DEFIBRILLATOR

- A. Product: Subject to compliance with requirements, provide Cardiac Science; Powerheart AED G3 Plus Automatic 9390a-1001P.
- B. Device Capacity: 30 full discharges or 210 minutes.
- C. Prompting: Audible and visual with graphic.
- D. Data Storage: Store ECG data for wireless transmission/downloading to a personal computer.

2.4 FABRICATION

- A. AED 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.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch 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 "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect mechanical finishes on exposed surfaces of AED cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish AED 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.

2.6 STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed AED cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for installing cabinets.
- B. Install AED cabinets in locations and at mounting heights indicated.
- C. AED Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed AED cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed AED cabinets.
- D. Install strobe above cabinet and connect to building security/alarm system.
- E. Install AED devices in each AED cabinet.
- F. Identification: Apply lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as AED cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust AED cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of AED cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace AED cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by AED cabinet manufacturers.

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- E. Replace AED cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104313

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
 - b. Fire hose valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of exposed finish required.

1.3 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- 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.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher and hose valve.
 - 1. Basis-of-Design Product Fire Extinguisher: Subject to compliance with requirements, provide JL Industries, Inc.: a division of the Activar Construction Products Group; Ambassador Steel Fire Extinguisher Cabinets, model 1015F10 or comparable product by one of the following:
 - a. Larsens Manufacturing Company.
 - b. Potter Roemer LLC.
 - 2. Basis-of-Design Product Hose Valve: Subject to compliance with requirements, provide Potter Roemer LLC; Alta Valve Cabinet 8000 series or comparable product by one of the following:
 - a. JL Industries, Inc.
 - b. Larsens Manufacturing Company.

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- B. Cabinet Construction: Nonrated, 1-hour fire rated, 2-hour fire rated as indicated by partition type in which cabinet is being installed.
 - 1. 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.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 - 1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
- E. Cabinet Trim Material: Steel sheet.
- F. Door Material: Steel 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 projecting door pull and friction latch.
- J. Accessories:
 - 1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Pressure-sensitive vinyl letters.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.
- 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 full range of industry colors and color densities.
 - 2. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.3 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 thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
 - 1. Fire-Protection Cabinets: 54 inches above finished floor to top of cabinet.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.

3.3 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

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 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

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 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. Potter Roemer LLC.
- 2. Valves: Manufacturer's standard.
- 3. Handles and Levers: Manufacturer's standard.
- 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container <Insert drawing designation>: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
- C. Clean-Agent Type in Steel Container <Insert drawing designation>: UL-rated 2-A:10-B:C, 14-lb nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.

2.3 MOUNTING BRACKETS

- A. 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.
 - 1. Wall mounted fire extinguishers to be provided in laboratories and utility rooms, unless specifically noted otherwise.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

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: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105210 - CYLINDER BRACKET SUPPORT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing and Installation of cylinder bracket support as drawn and specified.

1.2 SUBMITTALS

- A. Product Data:** Submit complete printed data and installation recommendations identifying items and features to be provided, demonstrating compliance with specifications.

1.3 QUALITY ASSURANCE

A. Qualification

1. **Installer Qualifications:** A party experienced in the installation of the Work required as a primary business for a minimum of five (5) years and acceptable to the product producer.

B. Regulatory Requirements

1. Conform to the requirements of authorities having jurisdiction including OSHA and NFPA.

1.4 DELIVERY, STORAGE, HANDLING

- A. Deliver in manufacturer's original unopened, undamaged packing containers bearing content labels.**
- B. Unload, handle, and store in exact accordance with manufacturer's/producer's recommendations in a manner to avoid loss, damage and contamination.**

1.5 PROJECT/SITE CONDITIONS

A. Environmental Requirements

1. Work only under environmental conditions acceptable to the product/materials manufacturer/producer.

B. Existing Conditions

1. Examine the substrate and conditions under which the work is to be performed and report conditions detrimental to a successful installation to the Contractor. Start of work will evidence acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with Contract Documents including these specifications provide materials by one of the following:**

1. Basis-of-Design: USA Safety, www.usasafety.com. (model BR1x2FS)
2. Architect approved equivalent.

2.2 MATERIALS

- A. Custom built stand which will hold up to 2 cylinders deep by width (number of tanks wide) as indicated on the drawings.

2.3 FABRICATION

- A. Fabricate in the shop to the extent possible. De-assemble and properly mark components as required for shipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in exact accordance with manufacturer's / producer's recommendations and submittals.
- B. Install secure, plumb, level and true to line and location free of restoration and rack in a permanent manner

3.2 CLEANING/ADJUSTING

- A. Clean inside and out in accordance with product manufacturer's recommendations.

END OF SECTION 105210

SECTION 110140 - BUILDING MAINTENANCE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This section is intended to cover the performance requirements of the Building Maintenance Equipment (BME). All work and material necessary to accomplish this complete installation shall be included, including shipping, hoisting, installation, and customs, except that specifically excluded.
- B. Any and all of the BME which must be installed in related work executed by others shall be identified and listed.
- C. Notwithstanding any reference in this performance specification to any article, device, product, material, fixture, form or type of construction by name, make or catalogue number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition and the BME Contractor, in such cases, may at their option use any article, device, product, material, fixture, form or type of construction which, in the judgment of the Owner and Architect, expressed in writing, is equal to that specified.

1.2 QUALITY ASSURANCE

- A. An approved equivalent contractor (manufacturer) shall be firm whose main concern and business is solely involved in the engineering design, manufacture and installation of power operated window washing units, and who has been actively engaged in this business for no less than ten (10) years.
- B. BME Systems Manufacturer: Provide BME Systems designed, engineered, manufactured and installed by:
 - 1. Guardian Fall Protection

1.3 CODES AND ORDINANCES, REQUIREMENTS OF REGULATORY AGENCIES

- A. All work and equipment, its performance, use, inspection testing and maintenance shall comply with the most stringent requirements of all applicable codes and jurisdictions, included, but not limited to the most recent amendment of the following:
 - 1. ANSI Z359, fall protection standard.
 - 2. Occupational Safety and Health Act (OSHA): OSHA Part 1910, paragraph 1910.66 Power Platforms for Exterior Building Maintenance. •
 - 3. Aluminum Association (AA): AA Specifications for Aluminum Structures. •
 - 4. American Institute of Steel Construction (AISC).
 - 5. AISC "Load and Resistance Factor Design Specification for Structural Steel Buildings," including the "Commentary" thereto.
 - 6. AISC "Code of Standard Practice for Steel Buildings and Bridges," including the "Commentary" thereto.
 - 7. American Welding Society (AWS): AWS D1.1 "Structural Welding Code, Steel," and AWS D1.2 "Structural Welding Code, Aluminum."
 - 8. Comply with the National Electric Code • , Electrical components shall be UL listed.
- B. The BME Contractor shall obtain any and all necessary approvals or permits as required by governing regulatory agencies.
- C. The work of this Section shall include obtaining and paying for any necessary inspection permits as required by the local inspection authority and making such tests as are called for by the regulations of such authorities.

- D. Required tests shall be made in the presence of the authorized representative of such local authorities. A certificate of adequacy of the whole installation and of the testing performed shall be issued by the BME Contractor.

1.4 COORDINATION OF CONDITIONS

A. Contractor to coordinate installation of structural steel and deck to meet requirements of roof fall protection system manufacturer.

- A. The BME Contractor shall coordinate related work and surfaces to ensure successful completion of work specified in this section.
- B. Submit the following to the Architect for review:
 - 1. Complete layout and configuration of suspended maintenance system, including components and accessories.
 - 2. Indicate design and fabrication details, hardware and installation details.
 - 3. Include installation and rigging instructions and:
 - a. Required restrictive working usage and general safety notes.
 - b. Non-restrictive working usage and general safety notes.
 - 4. Load Requirements: All loads imposed on the building structure and building exterior wall shall be shown. These loads shall be submitted to the Architect for review.
 - 5. Ensure shop drawings are review by an engineer licensed in the State of Kansas and submit calculations and test reports to the Architect.
- C. Parts Catalogue: Listing replacement parts, including identifying numbers and ordering instructions.
- D. Operating and Maintenance Instruction Manuals:
 - 1. Obtain ~~and hand over~~ **and supply to Owner** three complete sets of operating and maintenance instructions, after acceptance of instructions by the Owner's Representative and Architect, for items incorporated in the works. The English language instruction manuals shall be bound, neatly labeled and indexed **in both digital and print format**.
- E. Instruction Plates: Drawings and illustration metallic plates which are to be printed or etched, in English, of a non-corrosive material, to be supplied and installed, shall be submitted to the Architect for review. The platform shall also be provided with a name plate which includes the following ANSI/OSHA data:
 - 1. Name of Manufacturer.
 - 2. Name or Number of Model.
 - 3. Serial Number.
 - 4. Maximum load which may be so suspended in pounds.
 - 5. Year of Manufacture.

1.5 WARRANTY

- A. Warranty: Provide a one (1) year warranty against defects in material, workmanship, or installation for all components, providing for repair or replacement for a minimum period of one year, including material and labor.

1.6 DESIGN REQUIREMENTS:

- ~~A. **Wind Pressure: The installations shall be designed to withstand 25 miles per hour wind velocities while being used for normal operations and shall be fully operational at wind velocities up to 50 miles per hour. They also shall be designed to withstand 100 miles per hour wind velocity when in their secured stored positions.**~~

- B. The exposed areas subjected to wind pressure shall be the total areas of all portions of the exposed parts with no shielding effect of one element by another where the distance between elements is four times or more than the smaller projected area of the windward element.
- C. All structure assemblies and components shall be designed **OSHA standard of 5000 lbs or** with a safety factor of 2 to 1 **per OSHA 1926.502 (d) (8)** against failure as a minimum and to be so certified.
- D. Design system fall arrest safety anchors and equipment supports to AISC S342L (including supplement No.1 and ANSI/IWCA I-14.1, and as follows:
 - 1. Comply with OSHA 1910, Subpart F, Appendix C.
 - 2. Fall Arrest Safety Anchors:
 - a. Fall arresting force safety factor of 2 to 1 without permanent deformation: 1800 lbs minimum.
 - 3. Fall arrest force against fracture or detachment: 5,000 lbs minimum.

1.7 ACTION SUBMITTALS

- A. ***Delegated-Design Submittal: Building maintenance equipment indicated is to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation registered and licensed in the State of Missouri.***

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Anchors and Horizontal Lifeline Cable by Guardian Fall Protection; Anchors CB-18 weld on CB/XS Hybrid HLL System, or comparable product approved by the Architect.

2.2 GENERAL REQUIREMENTS

- A. All components shall be constructed of heat treated aluminum alloy, stainless steel, or hot-dipped galvanized structural steel. Dissimilar metals, when used, shall be protected against electrolytic actions.
- B. All connectors shall be stainless steel unless otherwise noted. All welds shall be made by certified welders and shall be examined by non-destructive testing.
- C. Components in contact with the façade and platform casters shall be on a non-marking and scuff resistant material.
- D. The exterior finish of all painted assemblies shall be of a color as directed by the Owner's Representative. All aluminum assemblies shall be of natural color. All carbon steel components shall be hot-dipped galvanized.
- E. The material sizes and thickness shown on the drawings are for conceptual design purposes. The manufacturer shall provide the final design and detailing of the equipment.

2.3 ANCHORS

- A. Safety Anchor Eye Plate: Mild steel, Type 300W with 44 Ksi minimum yield strength, hot-dip galvanized to ASTM A123/A123M.
 - 1. Plate: Minimum 0.875 inches diameter material with 2 inches eye opening.
- B. Hollow Steel Section (HSS) Piers: Mild steel, Type 300W with 50 Ksi minimum yield strength, hot dipped galvanized to ASTM A123/A123M.

1. Wall thickness to suit application.
- C. Plate and other sections: Mild steel, Type 300W with 44 Ksi minimum yield strength, hot dipped galvanized to ASTM A123/A123M.
 1. Wall thickness to suit application.
- D. Seamless Spun Aluminum Flashing (for Roof Anchors): To AA ADM-1 Type 6061-T6 alloy and to ASTM B221.
 1. Deck flange flashing: In accordance with Division 07 Section "Sheet Metal Flashing and Trim".
- E. Miscellaneous Bolts, Nuts and Washers: Mild steel, Type 300W with 44 Ksi minimum yield strength, hot-dip galvanized to ASTM A123/A123M.

2.4 HORIZONTAL CABLE LIFELINE

- A. Stainless steel to ASTM A492, Type 316, ~~0.3125~~ **5/16** inches minimum diameter cable, 9127 lbs minimum breaking strength with permanently swaged cable ends.
- B. Data plate: Ensure non-corrosive data plate stating Maximum Service Capacity of cable, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed at cable system entry points.
- C. Standard intermediate support brackets: Stainless steel to ASTM A167, Type 316, multi-position, with reinforcing end caps and suitable for installation at any height.
- D. Secure using 0.5 minimum diameter stainless steel fasteners.
- E. Corner units: 90 degrees and 135 degrees flexible corner units from manufacturer's standard components to meet project requirements.
- F. End terminal hardware: Stainless steel swaged termination at one end and stainless steel tensioner with shock absorber at other end to meet project requirements.
- G. Lanyard cable runner: Stainless steel to ASTM A167, Type 316 with automatic runner bypass for continuous "hands-free" operation.
- H. Ensure lanyard can be inserted or removed anywhere on cable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of anchors.

3.2 INSTALLATION

- A. Furnish, hoist and install all BME and components in strict accordance with the approved shop drawings and at such time as approved when construction and finish of adjoining work will permit and in sufficient time to avoid delays to the construction process. All BME shall be secured in place as shown on drawings and/or as herein specified by rigid approved methods.

3.3 FINISHES

- A. Galvanized surface damage shall be wire brushed and touched up with cold galvanized.

3.4 FIELD QUALITY CONTROL

- A. Repair or replace any components and correct all deficiencies observed during testing or demonstrations, and retest as required by the Owner to assure compliance with the Contract Documents.

3.5 ADJUSTMENT AND FINAL CLEANING

- A. Lubricate moving parts to operate smoothly and fit accurately.
- B. Complete "Initial Inspection - Certification for Use" form included in Equipment Manual and Inspection Log Book provided by manufacturer.
- C. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

END OF SECTION 110140

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SECTION 111319 - STATIONARY LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Recessed dock lifts.
2. Control stations.

1.2 DEFINITIONS

- A. Operating Range:** Maximum amount of travel above and below the loading dock level.
- B. Working Range:** Recommended amount of travel above and below the loading dock level for which loading and unloading operations can take place.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for stationary loading dock equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For stationary loading dock equipment.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of anchors and field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For stationary loading dock equipment to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with stationary loading dock equipment, including recessed pit dimensions and heights of loading docks, by field measurements before fabrication.

1.8 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace dock levelers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracked or broken structural support members, load-bearing welds, and front and rear hinges.
 - b. Faulty operation of operators, control system, or hardware.
 - c. Deck plate failures including cracked plate or permanent deformation in excess of 1/4 inch between deck supports.
 - d. Hydraulic system failures including failure of hydraulic seals and cylinders.
 2. Warranty Period for Structural Assembly: 10 years from date of Substantial Completion.
 3. Warranty Period for Hydraulic System: Five years from date of Substantial Completion.
 4. Warranty shall be for unlimited usage of leveler for the specified rated capacity over the term of the warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 HYDRAULIC DOCK LIFTS

- A. General: Recessed, hinged-lip-type dock levelers designed for permanent installation in concrete pits preformed in the edge of loading platform; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Blue Giant; ~~Model ED8/84x96-14S3~~ **LoMaster Dock Lift Series** or comparable product by the following:
 - a. Rite-Hite.
- B. Standard: Comply with MH 30.1, MH 29.1, and MH 30.3.
- C. Rated Capacity: Capable of supporting total gross load of 8000 without permanent deflection or distortion.
- D. Platform: Not less than 1/4-inch- thick, nonskid steel plate.
1. Platform Size: 72 by 96 inches.
 2. Frame: Manufacturer's standard.
 3. Toe Guards: Equip open sides of dock lift over range indicated with metal toe guards.
 - a. Toe-Guard Range: Entire upper operating range.
- E. Hinged Lip: Not less than 3/4-inch- thick, nonskid steel plate.
1. Safety Barrier Lip: Designed to protect material-handling equipment from an accidental fall from loading platform edge of the dock leveler when the leveler is not in use.
- F. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform.
1. Vertical Travel: Operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact with the following minimum working range:
 - a. Vertical Travel: 48 inch minimum, 60 inch maximum.

G. Operation:

1. Power Unit: Remote 5HP power pack on 12 feet hydraulic hose. Include all major components, motor, high-pressure gear pump, manifold, oil filters and oil reservoir. Power unit includes a pressure relief valve, load holding check valve, fixed pressure compensated flow control valve and poppet-type lowering solenoid valve. Oil filter located in the valve manifold (oil reservoir).
2. Remote push-button control station: Remote on 12 feet electrical cord. NEMA4 rated dual button control station, constant pressure type, complete with 'UP' and 'DOWN' buttons, 2-1/4 inches W by 4 inches H by 2-1/2 inches D in size. Controller includes a three pole magnetic motor starter with adjustable overload and a fuse protected 120-volt control transformer. Terminals provided for incoming power connection. Controller components are installed in NEMA12 rated enclosure, pre-wired and dielectric tested.
3. Power: 480v, 3 phase, 60 hz.

H. Construction:

1. Platform: Fabricated of heavy non-skid high tensile steel checker plate and reinforced with steel beams for maximum strength and rigidity. Platform sides have 8 inch beveled toe guard protection.
2. Hinged Bridge: Standard lip is piano-hinge type, 18 inches long by 60 inches wide, and is fabricated of non-skid high tensile steel checker plate. Lip edge is beveled. Plated lifting chain is provided.
3. Removable Handrails: Steel pipe 1.5 inches construction, 42 inches high, with mid-rail and 4 inches high kick plate. Handrail sockets are flush with platform surface. Chains are provided at both open ends between the rails.
4. Scissor Mechanism: Legs are fabricated of solid steel sections.
5. Cylinders: Minimum two piston type hydraulic cylinders. Rods constructed of hard-chrome steel and include self-adjusting polyurethane seals, positive internal stops, and fitted with vent lines. Hydraulic velocity fuse "fall safe" to prevent platform free fall is attached to each cylinder.
6. Bearings: All pivot points fitted with permanently lubricated Teflon impregnated bushings. Pivot pins made of hard-chrome plated steel.

I. Safety Devices:

1. Built-in, maintenance stop hinged to frame.
2. Safety velocity fuses on each cylinder.
3. Tapered toe guard protection and safety striping.
4. Warning labels.
5. Handrails and safety chain.

J. Finish and Color:

1. Toe guards supplied with high visibility yellow/black warning striping. Handrails painted safety yellow.
2. Unit painted blue.

K. Accessories:

1. Custom lip size and configuration.
2. Spring-assisted lips for ease of handling on heavier capacity.
3. Warning horn with adjustable volume control mounted on power unit (to indicate lift in motion).
4. Flashing amber warning beacon mounted on power pack.
5. Up travel limit switch.
6. Return line oil filter.
7. Accordion safety skirting
8. Mechanical roll-off barrier

9. Electric trip bars (to stop unit in case of down travel obstruction).
10. Mechanical pop-up wheel chock.
11. Interlock swing gates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.
- C. Examine walls and floors of pits for suitable conditions where recessed loading dock equipment is to be installed. Pits shall be plumb and square and properly sloped for drainage from back to front of loading dock.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.
- B. Clean recessed pits of debris.

3.3 INSTALLATION

- A. General: Install loading dock equipment as required for a complete installation.
 1. Rough-in electrical connections.
- B. Recessed Dock Lifts: Attach dock levelers securely to loading dock platform, flush with adjacent loading dock surfaces and square to recessed pit.

3.4 ADJUSTING

- A. Adjust loading dock equipment to function smoothly and safely, and lubricate as recommended by manufacturer.
- B. Test dock lifts for vertical travel within operating range indicated.
- C. After completing installation of exposed, factory-finished loading dock equipment, inspect exposed finishes and repair damaged finishes.

3.5 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of loading dock equipment Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper loading dock equipment operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain loading dock equipment.

END OF SECTION 111319

SECTION 113100 – RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cooking equipment.
 - 2. Warewashing equipment.
 - 3. Ice machine.
 - 4. Refrigerator.

1.2 COORDINATION

- A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.
- B. Coordinate locations and requirements of utility service connections.
- C. Coordinate sizes, locations, and requirements of the following:
 - 1. Overhead equipment supports.
 - 2. Equipment bases.
 - 3. Floor depressions.
 - 4. Insulated floors.
 - 5. Floor areas with positive slopes to drains.
 - 6. Floor sinks and drains serving foodservice equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include the following:
 - 1. Manufacturer's model number.
 - 2. Accessories and components that will be included for Project.
 - 3. Clearance requirements for access and maintenance.
 - 4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.
- B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.
- C. Samples for Verification: For each factory-applied color finish required, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For foodservice facilities.
 - 1. Indicate locations of foodservice equipment and connections to utilities.
 - 2. Key equipment using same designations as indicated on Drawings.
 - 3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
 - 4. Include details of seismic bracing for equipment.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For foodservice equipment to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Product Schedule: For each foodservice equipment item, include the following:
 - 1) Designation indicated on Drawings.
 - 2) Manufacturer's name and model number.
 - 3) List of factory-authorized service agencies including addresses and telephone numbers.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.
- B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.
- C. Regulatory Requirements: Install equipment to comply with the following:
 1. NFPA 70, "National Electrical Code."
- D. Seismic Restraints: Comply with SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines," Appendix A, "Seismic Restraint Details," unless otherwise indicated.

2.2 COOKING EQUIPMENT

- A. Microwave Ovens :
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Dacor MMDV30S or comparable product approved by the Architect.
 2. Description: 950-W cooking power.
 - a. Electrical Service: Equip unit with plug and cord for 120-V service.

2.3 WAREWASHING EQUIPMENT

- A. Warewashing Machines :
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Hobart LXiH Dishmachine or comparable product approved by the Architect.
 2. Description: Dishwashing, single tank.
 - a. Capacity: 3 gallons.
 - b. Electrical Service: Equip unit for connection to service indicated on Drawings.

2.4 ICE MACHINE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Hoshizaki C-101BAH-AD or comparable product approved by the Architect.

2.5 REFRIGERATOR

- A. Basis-of-Design Product: Subject to compliance with requirements, provide LG LFX28968ST or comparable product approved by the Architect.

2.6 MISCELLANEOUS MATERIALS

- A. Installation Accessories, General: NSF certified for end-use application indicated.
- B. Elastomeric Joint Sealant: ASTM C 920; silicone. Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.
 - 1. Public Health and Safety Requirements:
 - a. Sealant is certified for compliance with NSF standards for end-use application indicated.
 - b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.
 - 2. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

2.7 FINISHES

- A. Stainless-Steel Finishes:
 - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Powder-Coat Finishes: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.
 - 1. Connect equipment to utilities.
 - 2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.
- B. Complete equipment assembly where field assembly is required.
 - 1. Provide closed butt and contact joints that do not require a filler.
 - 2. Grind field welds on stainless-steel equipment until smooth and polish to match adjacent finish.
- C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.
- D. Install cabinets and similar equipment on bases in a bed of sealant.
- E. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

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- F. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.2 CLEANING AND PROTECTING

- A. After completing installation of equipment, repair damaged finishes.
- B. Clean and adjust equipment as required to produce ready-for-use condition.
- C. Protect equipment from damage during remainder of the construction period.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain foodservice equipment.

END OF SECTION 114000

SECTION 114000 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Foodservice Equipment as scheduled on the drawings

B. Whenever the term "Foodservice Equipment Sub-Contractor is used, it shall be the company that is the successful bidder and is awarded the contract for the erection and completion of the work that is outlined herein to the complete satisfaction of the Owner.

1.02 SUBMITTALS

A. Within ten calendar days after award of contract, the Foodservice Equipment Sub-Contractor is to supply in quadruplicate, fully dimensioned rough-in drawings and also, as required, plans indicating bases in the building upon which equipment is to set.

B. State the name of the fabricator of all custom fabricated equipment. Any change of source afterward shall be subject approval by the Owner.

C. Within thirty (30) days after award of contract, the Foodservice Equipment Sub-Contractor is to supply, in quadruplicate, a detailed set of shop drawings of custom fabricated equipment, at a scale of no less than 3/4" equals 1'0". Submit in quadruplicate, specifications sheets with full data on all items of brand name manufacturer, catalog cuts to be bound in booklet form and clearly identified with item number to correspond with itemized specifications, hereinafter indicated.

D. Approval of detailed shop drawings and specification sheets shall not waive obligation of Foodservice Equipment Sub-Contractor to furnish materials and methods of construction called for in specifications, even though they may be shown incorrectly, or, not at all, in the drawings.

E. Any substitute for materials specified, or changes in methods of construction from the way specified and shown on the approved detail drawings is to be requested, in writing, from the Owner, before any such substitution is applicable.

F. All equipment of brand name manufacture shall be of the latest model or succeeding model at the time of the delivery. Any price adjustment in this connection shall be requested of the Owner in writing.

1.03 WARRANTY

A. Submit Foodservice Equipment Sub-Contractor's guarantee for all workmanship, material and equipment, for a period of one (1) year from the time the equipment is put into operation and accepted by the Owner.

B. Guarantee and conditions of service on items of brand name manufacture, as established by the manufacturers, shall apply where extending beyond the guarantee and service set forth in these specifications.

1.04 QUALITY ASSURANCE

- A. The following are basic specifications of items of custom fabricated equipment covering the type and quality of materials, the method of fabrication, assembly and design and will be referred to in the itemized specifications by the term "as specified".
- B. All items of custom fabrication shall be the product of the single manufacturer of such equipment so as to insure uniformity throughout.
- C. All metal gauges shall be United States Standard.
- D. All workmanship shall be of the finest and all materials shall be new, of best quality and without flaws.
- E. All equipment shall comply with National Sanitation Foundation standards and all Federal, State and Local Health Codes.
- F. All gas equipment to be U.L. and A.G.A. approved.
- G. All electrical equipment shall bear Underwriter's seal of approval.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. All stainless steel, where specified, shall be type #302 18-8 analysis, nickel bearing steel. All exposed surfaces shall be standard #4 finish.
- B. All piecing of stainless steel, whether on cabinet surfaces or cabinet bases, shall be continuous welded joints. All welded joints shall be smooth and polished to original finish.
- C. Where galvanized iron is specified, it shall be copper bearing sheets, used in largest sizes with as few joints as possible. All welded joints shall be sandblasted and finished with rustproof galvanized zinc compound. All galvanized iron is to be finished with a prime coat and two (2) finish coats of hammerloid enamel.
- D. When plywood is used for backing, supports, construction of casework, it shall be no less than exterior grade plywood, manufactured per U.S. Product Standard PS-1-83, 5 or 7 ply, with waterproof glue.
- E. Where marine grade plywood is specified it will be manufactured per U.S. Product Standard PS-1-83, complete with Douglas Fir 1 and Western Larch. Plywood shall be 5 or 7 ply with waterproof glue.

2.02 PRODUCTS

A. PIPE STANDS AND OPEN BASE TABLES

- 1. All pipe stands shall be constructed of 1-5/8" O.D. 16 gauge steel tubing with all pipe joints welded, ground smooth and polished. Assembly of pipe stands by use of threaded or slip joint fittings will not be accepted. Tables over 6'0" in length shall have legs spaced not over 5'0" apart. Legs to be fitted at top with stainless steel full closed gussets, welded to the channel underbracing, or the table tops, and shall be fitted with approved, down 1-3/4", polished, stainless steel adjustable feet, with adaptation being internal.

2. All wood tops shall be 1-1/2" selected kiln dried maple strips, set on edge, glued together and bolted with steel rods running through from side to side. End of rods shall be counter sunk and concealed with maple plugs set flush with edges of tops. Top surface and edges shall be scraped and sanded smooth and the underside finished with one (1) coat of waterproof paint. All stainless steel tops shall have all corners welded also all seams. Welded seams shall be ground smooth and polished to match the adjacent surfaces. The edges, unless otherwise specified in itemized specifications, shall be rolled down 1-3/4", except where adjacent to walls or high adjoining equipment, where top is turned up 6" and back 1" on a 30 degree angle. Where turn-up meets top it shall be coved on a minimum of 3/4" radius. End apertures to be closed. All exposed leading corners shall be bull-nosed. Underside of worktop shall be galvanized iron. End apertures of channel bracing shall be closed. Where angle iron is lusted, it shall be 1-1/2" x 2" H.R., welded, extending around outer perimeter and 2'0" on centers. Underside of top shall be given a smooth coating of sound deadening mastic painted aluminum.

B. BASE CABINETS

1. All cabinet type bodies shall be constructed of 18-gauge stainless steel. Where entirely concealed from view, 18-gauge galvanized steel shall be used. Interior walls shall be galvanized where enclosed by doors, but of stainless steel where open to shelves. Vertical mullions shall be closed flush on the inner side.

C. FIELD JOINTS

1. All field joints in both tops and cabinet bases shall be completely welded on the job and ground smooth and polished to match original finish. Tack welding will not be accepted.

D. SERVICE PIPE CHASES

1. Cabinet bases are to be so constructed with adequate pipe chases provided in the equipment prior to delivery to the jobsite. If necessary to provide overlooked pipe chases in equipment delivered to the jobsite, they are to be provided by the Foodservice Equipment Sub-Contractor and are to be adequately finished to the complete satisfaction of the Owner.

E. SHELVES

1. All interior shelves and cabinet bases or counters shall be constructed of 18-gauge stainless steel, or, of gauges specified in itemized specifications. Under shelves for pipe base tables shall be constructed of 18-gauge stainless steel and are to have outside edges turned down 1-1/2" with 1/2" coved down edge, turned back 3/4" forming a channel. Shelves for both cabinet bases and pipe base tables are to be rigidly braced.

F. SINKS

1. All sinks shall be constructed throughout of 14-gauge stainless steel with all seams and joints welded, ground smooth, and polished to the original finish. To have all vertical and horizontal corners coved on a minimum of 3/4" radius to facilitate cleaning. All exposed edges to have a continuous 1-1/2" diameter semi-rolled rim. Where adjacent to walls provide a 6" high x 4" wide deck for faucets. Where away from the wall, the decks are to 6" high and 6" wide. Sinks shall be fitted with 2" twist lever drains and faucets as specified in installation requirements. Cross partitions between sink compartments shall be of double wall construction.

G. DRAINBOARDS

1. To be constructed of 14-gauge stainless steel and are to be welded integral with sink compartments. To have all vertical and horizontal corners coved and to have underside treated with sound deadened material and painted aluminum. Exposed edges are to be as constructed for sinks and where adjacent to walls, or adjoining equipment, to be turned up 3" and back 2" on a 45 degree angle. Drainboards under 3'0" long to be supported by stainless steel angles welded from end of drainboard to sink facing, just above cove of compartment bottom. Drainboards over 3'0" long to be supported on pipe stands, as previously specified. Unless otherwise noted, these drainboards will 1-1/2" deep, pitching to 2" at sink.

H. DRAWERS

1. All drawers shall be of 18-gauge stainless steel and shall measure approximately 20" x 20" x 5" deep, or size as specified in itemized specifications. Drawers shall be die formed, one-piece construction, with all corners coved and drawer body to be of lift out type. All drawer faces to be 16-gauge stainless steel double pan with full length, recessed integral, horizontal pull. Drawers shall operate on roller bearing slides, with nylon roller and are to be self-closing type. Drawer bodies to be removable for cleaning.

I. SLIDING DOORS

1. Sliding doors are to be of double wall construction. Exterior faces and edges of doors shall be of 18- gauge stainless steel. Spaces between doors shall be filled with approved sound proofing material. Doors shall operate on nylon rollers running in a sill at the bottom. Door shall lift out for cleaning and shall have overhead tracks constructed with a drop at the closing run to hold doors closed.

J. ELEVATED CABINETS

1. All elevated cabinets shall be of size specified and shall match base cabinet construction. To be of 16- gauge stainless steel throughout with top constructed as an integral part of body. Bottom of cabinet shall be closed flush.

K. CLOSURE PLATES

1. All equipment bodies, where resting on bases or against walls or columns, shall have 16-gauge stainless steel closure plates where any gaps may occur due to interference's or wall irregularities.

L. ELEVATED SHELVING

1. All elevated shelving shall be of length and width specified and constructed of 14-gauge stainless steel. All exposed edges shall be rolled down 1-3/4". Where butting walls or other equipment, the edges shall be coved up 2". Shelving shall be spaced and mounted as specified in itemized specifications.

M. PRESENT EQUIPMENT

1. Where specified in itemized specifications, present equipment is to be removed from present locations and installed in new locations, where shown on plans. Related trades are to see that all service lines are disconnected prior to Foodservice Equipment Sub-Contractor moving the equipment.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All valves, traps, tail pieces, fittings, cut-off switches, or other materials necessary for connections are to be furnished by related contractors, except where otherwise specified.
- B. All electrical equipment shall be correct for type of electric current available.
- C. All items of equipment specified with cord and plug shall match receptacle at the jobsite.

3.02 INSTALLATION

- A. The Foodservice equipment Sub-Contractor is to deliver and set in place, ready for related contractors to make required plumbing, electrical and ventilation connections, all equipment at locations where shown on plan.
- B. All equipment to be sealed to the walls.
- C. All refrigeration units are to be completely installed by the Foodservice Equipment Sub-Contractor except for final electric, water, if water-cooled units are used, and drain connections. The Foodservice Equipment Sub-Contractor is to furnish necessary charge of refrigerant, start and adjust equipment and service the same for a period of one (1) year after final acceptance by the Owner.

3.03 CLEANING AND PROTECTION

- A. Foodservice Equipment Sub-Contractor shall remove all debris accumulated during the delivery and installation of his equipment daily and immediately upon completion of said installation. He will provide a representative, when necessary, to correlate final hook-up by related contractors, so as not to impede job progress. After final hook-up, he shall lubricate, start up and check out all equipment requiring this service, and shall clean equipment and turn over to the Owner, for his final acceptance, in first class condition, all items in his contract.

3.04 COMMISSIONING

- A. The Foodservice Equipment Sub-Contractor shall provide a capable representative or representatives, to demonstrate the proper use of the equipment, at the time selected by the Owner. The Owner is to give the Foodservice Equipment Sub-Contractor a minimum of seven (7) calendar days prior to this demonstration date.

FOODSERVICE EQUIPMENT SPECIFICATION

ITEM 1, BACK COUNTERS: ONE (1) LOT REQUIRED N.I.C.

The Back Counter shall be furnished and installed by the G.C.

ITEM 2, WALL CABINETS: ONE (1) LOT REQUIRED N.I.C.

The Wall Cabinet shall be furnished and installed by the G.C.

ITEM 3, DOUBLE OVEN: ONE (1) REQUIRED N.I.C.

The Double Oven shall be furnished and installed by the G.C.

ITEM 4, REFRIGERATOR/FREEZER: ONE (1) REQUIRED N.I.C.

The Refrigerator/Freezer shall be furnished and installed by the G.C.

ITEM 5, BACK COUNTERS: ONE (1) LOT REQUIRED N.I.C.

The Back Counter shall be furnished and installed by the G.C.

ITEM 6, WALL CABINETS: ONE (1) LOT REQUIRED N.I.C.

The Wall Cabinets shall be furnished and installed by the G.C.

ITEM 7, MICROWAVE: ONE (1) REQUIRED N.I.C.

The Microwave shall be furnished and installed by the G.C.

ITEM 8, DROP-IN SINKS: TWO (2) REQUIRED N.I.C.

The Drop-In Sink shall be furnished and installed by the plumbing contractor.

ITEM 9, SPARE NUMBER

ITEM 10, DISH WASHER - UNDER COUNTER: ONE (1) REQUIRED

Manufacturer: Meiko

Model: FV 40.2 G
Cord and plug kit
Drain water tempering kit

Voltage: 208-60-1

ITEM 11, DROP-IN HAND SINK: ONE (1) REQUIRED N.I.C.

The Drop-In Hand Sink shall be furnished and installed by the plumbing contractor.

ITEM 12, UNDER COUNTER ICE MACHINE: ONE (1) REQUIRED N.I.C.

The Under Counter Ice Machine shall be furnished and installed by the G.C.

ITEM 13, ISLAND COUNTER: ONE (1) REQUIRED N.I.C.

The Island Counter shall be furnished and installed by the G.C.

ITEM 14, DROP-IN COOK TOP: ONE (1) REQUIRED N.I.C.

The Drop-In Cook Top shall be furnished and installed by the G.C.

ITEM 15, ISLAND HOOD: ONE (1) REQUIRED

Manufacturer: Captive Aire

Model: 5430 ND-2 (MOUNT AT 82" A.F.F.)

Description: The ND-2 series exhaust only canopy hood rated for all types of cooking equipment. The hood shall have the size, shape and performance specified on drawings. Construction shall be type 430 stainless steel with a #3 or #4 polish where exposed. Finished rear and end panels.

Individual component construction shall be determined by the manufacturer and ETI. Construction shall be dependent on the structural application to minimize distortion and other defects. All seams, joints and penetrations of the hood enclosure to the lower outermost perimeter that directs the captures grease-laden vapor and exhaust gasses shall have a liquid-tight continuous external weld in accordance with NFPA 96. Hood shall be island type with fully welded 10 gauge corner hanging angles. Corner hanging angles have a .625 x 1.500 slot pre-punched at the factory, allowing hanging rods to be used for quick and safe installations. Hanging rod and connect is provided by and installed by others.

Ventilator shall be furnished with U.L. classified aluminum baffle filters, supplied in size and quantity as required by ventilator. The filters shall extend the full length of the hood and the filler panels shall not be more than 6' in width.

The hood manufacturer shall supply complete computer generated submittal drawings including hood section view(s) and hood plan view(s). These drawings must be available to the engineer, architect and owner for their use in construction, operation and maintenance.

Exhaust duct collar to be 4" height with flange. Duct sizes, CFM and static pressure requirements shall be as shown on drawings. Static pressure requirements shall be precise and accurate; air velocity and volume information shall be accurate within 1-ft increments along the length of the ventilator.

U.L. incandescent light fixtures and globes shall be installed and pre-wired to a junction box. The light fixtures shall be installed with a maximum of 4'0" spacing on center and allow up to a 100 watt standard light bulb.

The hood shall have:

- A double wall insulated front to eliminate condensation and increase rigidity. The insulation shall have a flexural modulus of 475 EI, meet UL 181 requirements and be in accordance with NFPA 90A and 90B.
- An integral front baffle and rear capture flange to direct grease laden vapors toward the exhaust filter bank.
- A built-in wiring chase provided for outlets and electrical controls on the hood face and shall not penetrate the capture area or require an external chaseway.

- A removable grease cup for easy cleaning.

The hood shall be ETL Listed as "Exhaust Hood Without Exhaust Damper", NSF Listed and built in accordance with NFPA 96. The hood shall be listed for 450 F cooking surfaces at 269 CFM/ft, 600 F cooking surfaces at 300 CFM/ft, and 700 F cooking surfaces at 350 CFM/ft.

Enclosure Panels to finished ceiling as required

ITEM 16, DUCT AND FAN: ONE (1) REQUIRED

N.I.C.

The Duct and Fan shall be furnished and installed by the H.V.A.C.

ITEM 17, FIRE PROTECTION SYSTEM: ONE (1) REQUIRED

Manufacturer: Ansul

Model: R-102

1. The Kitchen Equipment Contractor shall furnish and install this item per the general and specific conditions complete with the following:
 - a. Furnish fire suppression system to meet NFPA standards 17A and 96, and be U.L. Listed to provide protection for plenum, exhaust duct collars and all grease producing cooking surfaces located under the ventilator. All piping, conduit, cable, etc., shall be concealed as applicable.
 - b. All nozzles and exposed piping to be chrome-plated or stainless steel. Size, number and location of nozzles and number of fusible links to be in accordance with U.L. limits for this particular system.
 - c. Manual control of the system shall be possible by actuation of remote release controls. Provide double-pole, double-throw, and electric snap action switch assembly.
 - d. Mechanical gas shut-off valves will be furnished loose and installed by the plumbing contractor. Electrical contractors (or Shut-trip breakers) required will be furnished and installed by the electrical contractor.
 - e. Obtain permits and conduct test of system in the presence of the owner's representative and the agency having jurisdiction.

Pre-piping of fire suppression system to be provided by ventilator manufacturer at factory

ITEM 18, FURNITURE: ONE (1) LOT REQUIRED

N.I.C.

The Furniture shall be furnished and installed by the G.C.

ITEM 19, CAMERAS AND DIGITAL SCREENS: TWO (2) REQUIRED

N.I.C.

The Cameras and Digital Screens shall be furnished and installed by the G.C.

ITEM NUMBER	ITEM DESCRIPTION	ITEM PRICE
1.	BACK COUNTERS	BY G.C.
2.	WALL CABINETS	BY G.C.
3.	DOUBLE OVEN	BY G.C.
4.	REFRIGERATOR/FREEZER	BY G.C.
5.	BACK COUNTERS	BY G.C.
6.	WALL CABINETS (1) LOT	BY G.C.
7.	MICROWAVE	BY G.C.
8.	DROP IN SINKS (2)	BY PLUMBER
9.	SPARE NUMBER	
10.	DISH WASHER-UNDER COUNTER	\$ _____
11.	DROP-IN HAND SINK	BY PLUMBER
12.	UNDER COUNTER ICE MACHINE	BY G.C.
13.	ISLAND COUNTER	BY G.C.
14.	DROP-IN COOK TOP	BY G.C.
15.	ISLAND HOOD	\$ _____
16.	DUCT AND FAN	BY H.V.A.C.
17.	FIRE PROTECTION SYSTEM	\$ _____
18.	FURNITURE (1) LOT	BY G.C.
19.	CAMERAS AND DIGITAL SCREENS (2)	BY G.C.

SECTION 115213 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrically operated, front-projection screens and controls.

1.2 DEFINITIONS

- A. Gain: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.
- B. Half-Gain Angle: The angle, measured from the axis of the screen surface to the most central position on a perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show layouts and types of front-projection screens. Include the following:
 1. Location of screen centerline relative to ends of screen case.
 2. Anchorage details, including connection to supporting structure for suspended units.
 3. Details of juncture of exposed surfaces with adjacent finishes.
 4. Location of wiring connections for electrically operated units.
 5. Wiring diagrams for electrically operated units.
 6. Accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For front-projection screens to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Environmental Limitations: Do not deliver or install front-projection screens until spaces are enclosed and weathertight, 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.

1.6 COORDINATION

- A. Coordinate layout and installation of front-projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, fire-suppression system, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Projection Screens: Obtain front-projection screens from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

2.2 ELECTRICALLY OPERATED, FRONT-PROJECTION SCREENS

- A. General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Controls: Remote, three-position control switch installed in recessed device box with flush cover plate matching other electrical device cover plates in room where switch is installed.
 - a. Provide two control switches.
 - b. Provide power supply for low-voltage systems if required.
 - 3. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
 - 4. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- diameter metal rod with ends of rod protected by plastic caps.
 - a. Roller for motor in roller is supported by vibration- and noise-absorbing supports.
 - 5. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen that is connected to edge of screen by tabs to pull screen flat horizontally.
- B. Suspended, Electrically Operated Screens with Automatic Ceiling Closure, with Motor-in Roller, and with Tab Tensioning: Units designed and fabricated for suspended mounting; with bottom of case composed of two panels, fully enclosing screen, motor, and wiring; one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Draper Inc; Signature/Series V.
 - 2. Provide metal or metal-lined wiring compartment.
 - 3. Screen Case: Made from metal.
 - 4. Provide screen case with trim flange to receive ceiling finish.
 - 5. Finish on Exposed Surfaces: Vinyl covering or baked enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.
- B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 - 1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.

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- a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.

3.2 FRONT-PROJECTION SCREEN SCHEDULE

- A. Electrically Operated, Front-Projection Screen Type: Suspended, with automatic ceiling closure.
 1. Motor Configuration: Motor in roller.
 2. Screen Surface: Matte white.
 3. Size of Viewing Surface: 60 by 96 inches.
 4. Extra Drop Length: 36 inches at bottom of screen.

END OF SECTION 115213

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SECTION 115300 - LABORATORY EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Laboratory Washers and Dryers:
 - 1. Laboratory Glassware Washers.
 - 2. Autoclave.

1.02 UNDIVIDED RESPONSIBILITY

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 123553 scope of work Related Sections.

1.03 REFERENCES

- A. Standards:
 - 1. ASTM A167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999.
 - 2. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials; 2000a.
 - 3. ASTM MT1010: Support Columns.
 - 4. ASME Section VIII, Division 1, Unfired Pressure Vessels Code: for steam coils.
 - 5. UL 1262, as certified by ETL Testing Laboratory Inc. (except units with pH neutralization and detergent monitoring system).

1.04 DESCRIPTION

- A. Furnish and install all laboratory equipment with necessary components and accessories required to ensure a complete installation and ready for intended use as specified herein and shown on the Laboratory Furnishings Drawings.
- B. Provide side panels to cover all exposed sides of cabinet-type equipment designed for under-counter installation.
- C. Work of this section requires close coordination with work of Division 15 and 16 as well as installation of Owner furnished components and work specified in other Sections. Sequence all work to assure an orderly progress in the project without removal of previously installed work and so as to prevent damage to finishes and products.
- D. Refer to General Laboratory Equipment Schedule included in this Specification.
- E. Utility Requirements: Mechanical and electrical services have been designed for the services and loads as described for individual equipment items herein. If a manufacturer requires services in excess of those indicated, either of type, size, quantity or quality, that cost will be borne by the Contractor and shall not be justification for a change order.
- F. Equipment Pits: Equipment pits shall be designed around standard pit of successful bidder. Manufacturer shall submit certified pit drawing within 30 days of Award of Contract from Owner to Contractor. Manufacturer shall provide height adjustments, thresholds, and other items required to finish off machines for pit mounted arrangement.

1.05 SUBMITTALS

- A. Materials List/Product Data: Submit for review a complete materials list, including catalog data and performance data of all materials, equipment, and products for work in this Section.
- B. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details, finished and materials dimensions, utility connections and locations, sizes and loads, and schedules. Show relationship to adjoining materials and construction and requisite service, operating and installation clearances. Piping and wiring diagrams shall be included. Shop Drawings shall be in the form of reproducibles or photocopies, not to exceed 11 inches by 17 inches (A3) in size. Blue-line or blackline prints are not acceptable.
- C. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer to show compliance with the applicable Building Code seismic restraint requirements.
 - 1. Equipment shall be designed and anchored in accordance with IBC 2009 Seismic Design Category C requirements.
- D. Samples: Submit for Architect's approval two (2) samples of each type of specified finish and color range available.
- E. Certifications: As a condition of acceptance, submit certification stating that equipment is complete and ready for intended function.
- F. Informational Submittals:
 - 1. Notice of factory testing.
 - 2. Manufacturer's installation, start-up and adjustment instructions.
 - 3. Statement of installer qualifications.
 - 4. Start-up report.
 - 5. Demonstration and instruction report.
 - 6. Factory Authorized Testing (FAT) Procedures: Requirements and Documentation. Include NIST calibration documentation.
 - 7. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and Owner's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and closest factory representative for components and service. Manual shall include non-proprietary list of all valves and other serviceable components.

1.06 REGULATORY REQUIREMENTS AND SUBSTITUTIONS

- A. Regulatory:
 - 1. Specified products, materials, or systems for Project may include engineering or on file standards required by the Regulatory Agency. Contractor's substitution of products, materials or systems may require additional engineering, testing, reviews, approvals, assurances, or other information for compliance with Regulatory Agency requirements or both. Contractor shall provide all Agency approvals or other additional information required, and pay for additional costs required for Architect's services made necessary by the substitution at no increase in Contract Sum or schedule time, and as a part of substitution proposal.
 - 2. When applicable, comply with:
 - a. Underwriters Laboratory Standards.
 - b. National Electrical Code.

1.07 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades. Maintain polyethylene film or other protective covering until start-up.
- B. Delivery of laboratory equipment shall occur after wet operations in building are completed.
- C. Receiving, distribution, and storage areas shall be of sufficient size and capacity to accommodate crated equipment.
- D. Laboratory equipment shall be stored in a ventilated area, protected from weather, with relative humidity of 50 percent or less at 70 degrees F (21 degrees C).
- E. Modular Wall/Equipment Enclosure Panels:
 - 1. Schedule delivery of modular wall system after wet operations in building are completed.
 - 2. Provide receiving, distribution, and storage areas of sufficient size and capacity to accommodate crated modular wall system.
 - 3. Store modular wall system in a ventilated place, protected from the weather, with relative humidity therein of 50 percent or less at 70 degrees F.
 - 4. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.
 - 5. Painting and Other Finishing Trades. Protect installed modular wall system from debris, paint and damage from adjoining construction work.
- F. Replacement: Any damage as a result of this contractors work will be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to the Owner.

1.08 QUALIFICATIONS

- A. Contractor for work in this section shall have an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits. Contractor and manufacturers for work of this section shall have a minimum of five years and ten installations experience installing products specified.

1.09 MAINTENANCE SERVICE

- A. Furnish routine preventative and emergency maintenance service for two years from final acceptance. Maintenance service shall supplement warranty requirements.
- B. Include periodic examination, adjustment, and maintenance of equipment. Repair or replace worn parts, using only standard parts produced by equipment manufacturer.
- C. Furnish 7-day-a-week emergency service during maintenance period, providing maintenance personnel on site within 24 hours, should a shutdown or emergency develop between regular examinations.

PART 2 PRODUCTS

2.01 LABORATORY GLASSWARE WASHERS: BASE CABINET HEIGHT

- A. Basis of Design: Labconco SteamScrubber (4578020 series) Undercounter FlaskScrubber Glassware Washer, or equivalent.
1. Glassware washer having stainless steel top and bottom racks that accommodate basket inserts for a wide variety of glassware shapes and sizes, primarily beakers and other wide-mouth glassware. Specialized inserts are available for BOD bottles, Petri dishes, culture tubes and small utensils.
 2. Installation Type: Under work surface. See Laboratory Furnishing drawings for location. Provide side panels to cover exposed sides of equipment not concealed by casework.
 3. Construction:
 - a. Tank: Type 304 stainless steel with mirror finish.
 - b. Wash arm and tower: Type 304 stainless steel with mirror finish.
 - c. Insulation: Fiberglass blanket; aluminum-backed acoustic material.
 - d. Interior light: 25 W, lit when door latch is engaged.
 - e. Exterior: Type 304 stainless steel door and sides; epoxy-coated steel back.
 4. Operation:
 - a. Control: Ten factory preset programs – Rinse only, Plastic, Glass, Glass plus, Scientific, Scientific Plus, Intense, Intense Plus, Extreme, Dry Only – and two user set programs. Except for Rinse only, program parameters may be altered by the user.
 - b. Control panel: Injection molded panel with control and program change buttons and LCD display.
 - c. Detergent dispenser for powder or liquid detergent.
 - d. Neutralizing solution dispenser for rinse cycle.
 - e. Purified water pump to supply pressurized or non-pressurized purified water for the rinse cycle.
 - f. Steam generator to provide steam before the Wash 2 cycle of any program except Rinse only and Plastic.
 5. Operating Requirements:
 - a. Hot water: 120 degrees F minimum, 140 degrees F recommended, 200 degrees F maximum.
 - b. Electric: 208/230 volt, 50/60Hz, 12 amp, high heat (20 A dedicated circuit required).
 6. Accessories required:
 - a. Two wash arms and a spindle rack with 36 detachable spindles constructed of Type 304 stainless steel.
 - b. Upper rack with additional wash arm.

2.02 AUTOCLAVE

- A. Autoclave:
1. Basis of Design: Heidolph North America; Model 5075 HSG or equivalent product approved by the Architect.
 2. Description:
 - a. Chamber Dimensions: 19.5 inches wide by 29.5 inches.
 - b. Chamber Volume: 160L.
 - c. Finish: stainless steel with No. 4 finish.
 - d. Steam Source: Electric steam boiler.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordinate with Divisions 15 and 16 for location, size, and type of mechanical, power and communications services required.
- B. Before shipping, equipment shall be cleaned inside and outside, be free of rust, loose scale, and other deposits. Finished surfaces shall be protected to prevent shipping and/or storage damage. All threaded connections, flanges, and couplings shall be protected.
- C. Equipment to be disassembled before shipment to allow for rigging through a 72 inch by 84 inch door frame at the job site. Delivery shall be coordinated so that equipment can be positioned in-place prior to installation of door frames of smaller dimensions.
- D. Equipment to be securely crated and/or packaged to prevent damage during shipment. Loose parts shipped inside of the unit shall be secured.
- E. The vendor shall be responsible for delivery of the unit(s) to the job site, setting the equipment in place, unpacking and reassembly.
- F. The vendor shall verify that required utilities are available, in proper locations, and ready for use.
- G. Beginning of installation means acceptance of existing conditions by the vendor.
- H. Upon unpacking of the equipment, the vendor shall remove all debris, crating material and packaging from the location.

3.02 SITE CONDITIONS

- A. Inspection: Prior to installation of laboratory equipment, carefully inspect the installed work specified in other Sections and verify that all such work is complete to the point where this installation may properly commence.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect.

3.03 EXAMINATION

- A. Examine surfaces designated to receive work for conditions that would adversely affect the finished work. Repair or replace surfaces not meeting tolerances or quality requirements governing substrate construction prior to start of work.
- B. Verify that surfaces, prepared openings, or support structures are ready to receive work.
- C. Verify field measurements and opening dimensions are as instructed by manufacturer.
- D. Inspect and verify that the required utilities are available, in proper locations and ready for use, prior to equipment installation.

3.04 WORK REQUIRED OF OTHER SECTIONS PRIOR TO INSTALLATION

- A. Install shutoff valves on service lines.

- B. Install fused disconnect switches (with lockout in OFF position) in electric supply lines near the equipment.
- C. Provide building service lines supplying specified pressures and flow rates.
- D. Provide illumination of service area, with provision of convenience outlet for maintenance.

3.05 FACTORY ACCEPTANCE TESTING (FAT)

- A. Equipment requiring FAT:
 - 1. Glassware washers.
- B. Equipment shall be provided with service identical to those that will be provided on site, including piped services connections, flows and temperature, as applicable, and electrical service.
- C. The manufacturer shall:
 - 1. Issue Factory Acceptance Test protocols and notification to the Owner at least 30 days in advance of scheduled testing for Owner comment and approval.
 - 2. Execute tests and measurements.
 - 3. Analyze test results.
 - 4. Describe any and all deviations in test report and make any necessary corrections. Retest/repeat procedures, if required.
 - 5. Check that register deviations are complete and documentation is correct.
 - 6. Verify calibration of test equipment.
 - 7. Check the conclusion of the test conformity.
 - 8. Sign test report after completion and submit to Owner.
- D. Test requirements:
 - 1. Performance testing of equipment on items to be processed in accordance with the inspection procedure below:
 - a. Manufacturer and Owner will coordinate the provision of items to be processed supplied either by Owner or from a research facility in local proximity to the equipment supplier's factory.
 - b. Manufacturer and Owner will coordinate number and types of items to be processed during factory testing.
 - c. During performance testing, items to be processed will be visually inspected and must be accepted as being physically clean, free of dirt, unsoiled, and unstained.
 - d. Cycle time performance will be compared to target cycle times specified above. Equipment supplier shall work with Owner to make adjustments at the factory to minimize cycle times should these times exceed target performance.
- E. Owner's authorized representative(s) shall have the right to inspect all work during and after fabrication completion and shall perform and witness testing. This inspection shall occur at the vendor's manufacturing facility. Facility shall have utilities as required to perform full testing of the equipment. The representative's decisions to reject material or workmanship for non-compliance with the Specification, Drawings and purchase order shall be final.
- F. Owner's representative(s) inspection shall include, but not be limited to the following items:
 - 1. Manufacturer's adherence to the terms of Purchase Order, particularly in the areas of schedule and required documents.
 - 2. Manufacturer's adherence to the Contract Documents, including any latest revisions thereof.
 - 3. Manufacturer's adherence to fabrication procedures as mandated by Code, Specifications and Drawings.

4. Fabrication within tolerances as established by Code, Specifications, and Drawings, whichever is most stringent.
 5. Full operation of the equipment including proper functioning of the following items:
 - a. Microprocessor controls.
 - b. Valves.
 - c. Pumps.
 - d. Sensors.
 - e. Alarms.
 - f. Printers.
 - g. Safety features.
 - h. All operational cycles.
 - i. All other operational components of the sterilizer.
 6. Overall workmanship of equipment and accessories.
- G. FATs shall include the following:
- a. Verification of equipment and scope of delivery.
 - b. Verification of the pipe work.
 - c. Verification of mechanical installation.
 - d. Verification of electrical installation.
 - e. Verification of utilities.
 - f. Verification of documentation.
 - g. Vacuum leak rate test.
 - h. Test protocol run analysis.
- H. Manufacturer shall prepare and maintain a Deviation Tracking List identifying all deviations or faults that occur during the FAT.
- I. Acceptance by the Owner's representative shall not relieve the manufacturer of the responsibility for workmanship conforming to the Contract Documents and the Purchase Order.

3.06 INSTALLATION

- A. General:
1. Equipment shall be installed by personnel approved by the manufacturer.
 2. Install all equipment per manufacturer's recommendations and reviewed submittals.
 3. Properly align and position all equipment.
 4. Refer to Section 01 45 00 for Quality Control of Installation.
 5. Manufacturer's Field Services:
 - a. Refer to Section 01 45 00.
 - b. Provide manufacturer's field services to supervise installation. Manufacturer's personnel shall be on site prior to installation to inspect field conditions and make preparations for installation. Installation shall be under the direct supervision of the manufacturer's personnel until the completion of initial start up.
- B. Modular Wall/Equipment Enclosure Panels:
1. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.
 2. Bolt panels to adjacent panels through pre-drilled holes. Bolt channel clips to underside at top and bolt to support column at rear.
 3. Install ceiling trim angles using expansion shields and screws.
 4. Anchor vertical panels to floor with expansion bolts.
 5. Protect installed modular wall system from debris, paint, and damage in the course of the construction sequence.
- C. Connection to Building Systems: Refer to Laboratory Plumbing and Electrical drawings and Divisions 15 and 16 for final connections.

3.07 START UP AND TESTING

- A. Test, clean, and adjust equipment and apparatus installed to ensure performance meets specified requirements.
- B. Operate each unit and test full range of cycles over a continuous period. Record test data.
- C. Adjust and re-test any units not meeting requirements.

3.08 Demonstration and Instructions

- A. Test equipment prior to demonstration. Ensure equipment, including specified accessories, is operational.
- B. Provide demonstration of equipment operation and instruction of Owner's personnel.
- C. Demonstration operating capability of equipment and systems. Include control and safety features, and service and maintenance procedures.
- D. Engage services of qualified instructor to instruct and train Owner's operating and maintenance personnel in operation, service, and maintenance of equipment. Provide at least two hours of instruction for each type of equipment.

3.09 CLEANING AND PROTECTION

- A. All equipment shall be protected before, during and after installation. Protect from paint, debris, and damage in the course of the construction sequence. Damage to material due to improper protection shall be cause for rejection.
- B. Packaging and debris and other waste resulting from installation of equipment shall be removed.
- C. At no time shall worker use the installed equipment as a work bench, scaffolding, or for other uses.
- D. Repair or remove and replace defective Work as directed by the Architect upon completion of installation.
- E. Clean finished equipment, touch up as required and remove and refinish damaged or soiled areas.
- F. Prior to final acceptance by the customer, equipment that has become damaged will be repaired or replaced according to the terms of the warranty and any external soiled surfaces will be cleaned.

END OF SECTION

SECTION 115313 - LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bench-top laboratory fume hoods.
2. Fume hood base stands.
3. Piping and wiring within fume hoods for service fittings, light fixtures, fan switches, and other electrical devices included with fume hoods.

B. Related Sections:

1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking for anchoring fume hoods.
2. Division 09 Section "Non-Structural Metal Framing" for reinforcements in metal-framed partitions for anchoring fume hoods.
3. Division 12 Section "Laboratory Casework" for fume hood base cabinets, including work tops, sinks, and service fittings.
4. Division 23 Sections for fume hood duct connections, including ducts and exhaust fans.
5. Division 23 and 26 Sections for connecting service utilities at back of fume hoods. Piping and wiring within fume hoods are specified in this Section.
6. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for field quality-control after testing of fume hoods by this section.

1.2 PERFORMANCE REQUIREMENTS

- ##### A. Fume hoods shall be of belted counterweight sash / aerodynamic entry design to insure maximum operating efficiency. Sash and air entry framework of the hood shall minimize eddying of air currents at the hood face and Cartesian rear baffle system shall minimize turbulence and vortices in all portions of the hood interior.

B. Constant Volume Fume Hood:

1. Constant Volume Fume Hood designed to yield 84 FPM face velocity at 18 inch sash opening
2. Maximum sash opening to be 28 inch, yielding 55 FPM face velocity
3. Sash auto-return feature shall return the sash to 18" if opened wider
4. A full-open sash latch to facilitate fume hood set-ups
5. Notched belt and sprocket sash system

C. Containment:

1. Test Method: The hood shall be tested per the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 110-1995.
2. Location of Tests and Test Facility: All tests referenced herein shall be performed in the bidder's fume hood test facility. Field-testing is described in PART 3.
 - a. The test facility shall have sufficient area so that a minimum of 5 feet of clear space is available in front of and on both sides of the hood for viewing tests.
 - b. The facility's ventilation system shall have adequate heating and air conditioning so that room air temperatures can be maintained within the desired ranges.
 - c. Standard room air currents in the test area shall be less than 15 FPM.
 - d. The hood exhaust system shall be properly calibrated so that the desired exhaust air volumes can be easily attained.
 - e. Make-up air to the test room shall be ceiling-supplied as in a standard chemical laboratory.

3. Instrumentation, Equipment and Test Personnel: Qualified personnel to perform the tests shall be supplied by the bidder. Instrumentation and equipment required shall be supplied by the bidder at their expense. Required instrumentation shall include but not be limited to the following items:
 - a. Thermal anemometer capable of measuring air velocities from 10 to 600 ft./minute
 - b. One-half minute smoke candles or other source of high volume smoke
 - c. Smoke tubes or other source of localized smoke
 - d. Miran 103 analyzer calibrated to indicate concentration of sulfur hexafluoride or equivalent.
 - e. Flowmeter - 15 L/minute capacity
 - f. Tank of sulfur hexafluoride with a two-stage regulator or other tracer gas suitable for detector to be used
 - g. Adjustable mannequin, 5 feet to 5 feet 8 inches in height, with reasonable human proportions and arms hanging at its side
 - h. ASHRAE 110-1995 tracer gas ejector
 4. ASHRAE Test: Standard 110-1995 Test,
 - a. Hood shall be tested with a face velocity of 55 FPM with the sash at the maximum opening, 28". The hood shall have a performance rating in the static portion of ASHRAE 110-1995 of AM 0.01 or better wherein:
 - 1) 4.0 = tracer gas release in liters/minute
 - 2) AM = as manufactured
 - 3) 0.01 = 5 minute time average level of control of tracer gas in parts per million (PPM)
 5. ASHRAE 110-1995 Perimeter, Sash Movement Tests, and Cross Draft Requirements:
 - a. The hood shall have a maximum perimeter reading of 0.01 PPM or less.
 - b. The hood shall have a maximum sash movement value of 0.05 PPM or less.
 6. Twisting Manikin Test: A manikin mounted to a twisting base will be placed in standard ASHRAE 110 position. Arms will be altered to hold objects similar in dimension to two 600 ml beakers inside the hood. Manikin twist angle will be such that at the extreme right and left rotational positions, one "beaker" is outside the sash plane. At a rotation rate of 4 cycles per minute, a four-minute run will be undertaken with a sensor in the manikin breathing zone. Average breathing zone concentration shall remain less than 0.05 PPM.
- D. Structural Performance: Provide fume hood components capable of withstanding the following loads without permanent deformation, excessive deflection, or binding of cabinet drawers and doors:
1. Fume Hood Base Stands for Fume Hoods Other Than Radioisotope Hoods: 50-lb/ft. work top, 75 lb/ft. on work top, plus weight of hood.
- E. Delegated Design: Design fume hoods, including comprehensive engineering analysis by a qualified professional engineer, using seismic performance requirements and design criteria indicated.
- F. Seismic Performance: Fume hoods, including attachments to other work, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
1. Design earthquake spectral response acceleration, short period (Sds) for Project is as indicated on Drawings.
 2. Component Importance Factor is 1.5.

1.3 ACTION SUBMITTALS

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

- B. Shop Drawings: For laboratory fume hoods. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports. Include calculations demonstrating that anchorages comply with seismic performance requirements.
 - 2. Indicate locations and types of service fittings together with associated service supply connection required.
 - 3. Indicate duct connections, electrical connections, and locations of access panels.
 - 4. Include roughing-in information for mechanical, plumbing, and electrical connections.
 - 5. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from above items.
 - 6. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
 - 7. Include coordinated dimensions for laboratory equipment specified in other Sections.
- C. Samples for Initial Selection: For fume hood exterior finishes.
- D. Samples for Verification: For fume hood exterior finishes and interior lining, in manufacturer's standard sizes.
- E. Delegated-Design Submittal: For fume hoods indicated to comply with seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss based on evaluation of comprehensive tests according to SEFA 1.2, "Laboratory Fume Hoods – Recommended Practices" and ASHRAE 110, performed by manufacturer and witnessed by a qualified testing agency.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Laboratory Fume Hoods: Obtain fume hoods from single manufacturer.
 - 1. Obtain from same source from same manufacturer as laboratory casework specified in Division 12 Section "Laboratory Casework."
 - 2. Completely coordinate all details with laboratory casework manufacturers and installers, including base cabinets, service clearances, etc.
- B. Product Designations: Drawings indicate sizes, types, and configurations of fume hoods.
- C. Testing: The hood manufacturer shall maintain a testing facility at its place of business for the testing of bench-mounted laboratory hoods in accordance with ASHRAE Standard 110-95.
- D. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods - Recommended Practices." Provide fume hoods UL listed and labeled for compliance with UL 1805.
- E. Safety Glass: Products complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
 - F. Electrical Components, Devices, and Accessories: All fume hoods shall meet the requirements of the UL 1805 classification. Provide NEMA 5-20R GFCI Red Duplex devices at all electrical outlets.
 - G. Preinstallation Conference: Conduct conference at Project site.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.
- 1.8 PROJECT 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.
- 1.9 COORDINATION
- A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.
 - B. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.
- 1.10 WARRANTY
- A. Manufacturer's warranty against defects in material or workmanship on its fume hoods shall be for one (1) year from the date of Substantial Completion or two (2) years from the date of purchase, whichever is later. Warranty shall include replacement of parts, except lamps.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Drawings indicate size, profiles, and dimensional requirements and are based on specific systems indicated. Subject to compliance with requirements, provide products by one of the following:
 1. Kewaunee Scientific Corporation; LV05K543448-00GHD67 and LV05K543472-00GHD67 both with LED lighting (Basis-of-Design)
 2. Fisher Hamilton LLC
 3. Jamestown Metal Products
 4. LabCrafters

2.2 MATERIALS

- A. Fume Hood Superstructure Frame: A structure of steel support members shall be provided to support exterior panels and interior liner and baffle panels. To allow for maintenance and replacements, the baffle panels shall be removable without disassembly of the frame structure and outer steel panels. Likewise, the exterior steel panels shall be removable without disassembly of the frame structure and inner liner panels.

- B. Fume Hood Interior Walls: Double wall ends, not more than 4.5 inches wide, with sash track flush with front vertical facia, shall be provided to maximize interior working area. The area between the double wall ends shall be closed to house the remote control valves. The front vertical facia shall be in a plane 45 degrees from the hood face and end walls. This facia shall contain space for the required service controls and electrical devices.
- C. Fume Hood Airfoil: A 12 gauge painted stainless steel, convergence z-cross section airfoil shall be mounted flush to the bottom of the hood opening. It shall provide no open space between it and the top front edge of the worksurface. The foil shall assure a flow of air rearward within 1/2 inch above the worksurface at all hood operating face velocities.
- D. Fume Hood Top Panel: Fume hood top panel shall incorporate a dynamic barrier bypass providing a clean air stream behind the sash plane.
- E. Fume Hood Baffles: The fume hood baffles shall be constructed of the same material as the hood lining. They shall consist of multiple sections with vertical slots and a continuous horizontal slot at the worksurface. Each baffle panel shall be easily removable from the interior, without requiring liner disassembly.
- F. Fume Hood Duct Collar: Each fume hood up to six feet in length shall contain one (1) 12 inch stainless steel bell-mouthed duct collar in the hood roof for exhausting the hood. Fume hoods over six feet in length shall contain two (2).
- G. Fume Hood Lighting: Manufacturer's standard LED lighting for model indicated.
- H. Fume Hood Vertical Sash: A vertical rising sash of 1/4 inch laminated safety glass shall be provided. The sash shall have a neutral colored polyvinyl chloride horizontal member at the top and a full-length aerodynamic aluminum handle at the bottom. The sash shall be counterbalanced with a single weight to prevent tilting and binding during operation. The sash shall be connected to the counterweight system with two, 1/2 inch wide stainless steel-reinforced polyurethane notched belts that engage a sprocketed shaft drive and be so configured that when lifted higher than 18 inch, the sash will return to the 18 inch operating position automatically. The sash shall provide a 35-1/2 inch viewing height, with a maximum opening of 28 inch and shall incorporate a mechanism for latching it in the full-open position for hood set-up.
- I. Front Mounted Remote Control Fittings: Service fitting valves shall be mounted on the hood front vertical facia with the working components of the valve accessible from the hood exterior. Valves shall be furnished with 2-1/4 inch diameter, 2 inch high, round handles with color-coded index buttons and color-coded service outlet. Service outlets shall be mounted on the hood interior sidewall liner in a staggered arrangement, with the lowest outlets closest to the front, and the highest outlet closest to the rear.
- J. Fume Hood Electrical Fixtures: The hood superstructure shall be pre-wired and contain a UL label certifying acceptable wire gauge, connections, fixtures and wire color-coding. Electrical fixtures shall consist of two duplex receptacles and a light switch. The duplex receptacles shall be 20 Amp., 125 volt AC, and 3-wire polarized grounded with ground fault interruption. The receptacles shall be specification grade, side wired only, to insure a positive connection. The light switch shall be 20 Amp, 125 volt AC, and 3-wire polarized grounded. Wiring shall terminate in one 6 x 6 x 4 inch service junction box located on the fume hood roof. Final wiring and circuit dedication shall be by others.
- K. Epoxy Resin: Hood worksurface shall be 1-1/4 inch thick molded epoxy resin made in the form of a watertight pan, not less than 3/8 inch deep to contain spillage with a 6 inch wide safety ledge across the front edge. Top shall be manufactured at the same manufacturing location as the fume hood to assure proper cutout alignment and coordinated shipping. A cup drain flush with the recessed worksurface shall be provided. The worksurface and cup drain shall be available in either black or grey. The nominal 3 X 6 inch cupsink shall be of an anti-splash design with a horizontal rear outlet not extending more than 7 inch below the worksurface.

- L. Access Opening: The interior end liner panels shall be furnished with a triangular shaped opening that provides access to the service piping and valves to facilitate installation and maintenance. The openings shall be filled with a removable gasketed panel made from fume hood liner material.
- M. Fume Hood Dimensions: Double wall end panel thickness shall not exceed 4.5 inch. Interior clear working height shall be not less than 38 inches at any location in the interior of the hood on bench hoods. Interior depth from the back of the sash to the front of the rear baffle shall not be less than 24 inches. The sash opening shall be not less than 28 inches in height above the worksurface on bench hoods.
- N. KMER Epoxy Resin Lining: KMER epoxy resin liner shall be the manufacturing standard for liners in this specification. To assure proper punching and coordination with remaining pieces of assembled fume hood superstructure, this liner material must be manufactured at the same geographic location as the fume hood superstructure. Interior liner panels shall be 1/4 inch thick epoxy resin sheets of a neutral color. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads. The material shall have an ASTM E84 Class A flame spread rating (25 or less). Fiberglass reinforced plastics or polyesters shall not be acceptable substitute liner materials for epoxy resin.
- O. Fume Hood Base Cabinets:
 - 1. Standard Steel: Unless otherwise indicated base units under hoods shall be fabricated of cold rolled prime grade roller leveled furniture steel. Gauges of steel used in construction shall be 18 gauge except as follows:
 - a. Corner gussets for leveling bolts and apron corner braces, 12 gauge.
 - b. Hinge reinforcements, 14 gauge.
 - c. Top and intermediate front horizontal rails, apron rails and reinforcement gussets, 16 gauge.
 - d. Door assemblies and adjustable shelves, 20 gauge.
 - e. Performance of the painted surfaces shall match that of the fume hood outer panels.
 - 2. Special Purpose Cabinets for Use Under Fume Hoods:
 - a. Acid Storage Cabinets: Where indicated acid storage cabinets shall use the same gauges of steel and construction features as other base cabinets. In addition, they shall have a one-piece liner insert made of linear low-density polyethylene. The liner insert shall form a one-inch pan at the bottom to retain spillage. Each door will have a set of louvers at the top and bottom. The door shall be lined with a polyethylene sheet. Each cabinet shall be vented into the fume hood with a 1-1/2 inch vent pipe, providing a positive airflow directly into the fume hood exhaust system.

- b. Solvent Storage Cabinets: Solvent storage cabinets shall be FM labeled and specifically designed for the storage of flammable and combustible liquids. Construction shall be based upon the requirements listed by UFC, OSHA, and NFPA No. 30 - 2003. The bottoms, top, sides and doors shall be fabricated of 18 gauge steel and shall be all double panel construction with a 1-1/2 inch air space between panels. All joints shall be welded, or screwed, to provide a rigid enclosure. The doors shall swing on full-length stainless steel piano hinges and shall be fully insulated. The right hand door shall be equipped with a three point latching device and the left-hand door shall have a full height astragal. The doors shall be self-closing and synchronized so that both doors will always fully close. The right hand door shall be equipped with a three-point latching system that automatically engages when the doors close. Each door shall be equipped with a fusible-link hold-open feature that will ensure the door closes should the temperature outside the cabinet exceed 165 degrees Fahrenheit. Units 24 inch long shall have only one door, self-closing, and equipped with a three-point latching system and hold-open feature. A 2 inch deep liquid tight pan that covers the entire bottom of the cabinet shall be furnished to contain liquid leaks and spills. A full-depth adjustable shelf shall also be provided. The shelf shall be perforated to allow air circulation within the cabinet. Two diametrically opposed vents with spark screens shall be provided in the back of the cabinet as well as a grounding screw. The cabinet shall have an interior finish the same as the exterior and shall be labeled: "FLAMMABLE - KEEP FIRE AWAY".

P. Fume Hood Finish:

- 1. After the component parts have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish system to the steel and to aid in the prevention of corrosion. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine grained crystalline phosphate surface that shall provide both an excellent bond for the finish and enhance the protection provided by the finish against humidity and corrosive chemicals.
- 2. After the phosphate treatment, the steel shall be dried and all steel surfaces shall be coated with a chemical and corrosion-resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.

2.3 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 (0.05 mm).

1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions. Include independent test results documenting SEFA 8.
2. Colors for Fume Hood Finish: White to match Architect's samples.

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 Shop Drawings and manufacturer's written instructions and in compliance with standards required by authority having jurisdiction. 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.
- B. Comply with requirements in Division 12 Section "Laboratory Casework" for installing fume hood base cabinets, work tops, and sinks.
- C. Comply with requirements in Divisions 22 and 26 Sections for installing water and laboratory gas service fittings and electrical devices.
 1. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work top material. Securely anchor fittings to fume hoods unless otherwise indicated.

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 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.
- B. Test one or 5%, whichever is greater, of each type of installed fume hood, according to ASHRAE 110 as modified in "Performance Requirements" Article. If tested hood fails to meet performance requirements, field test additional hoods as directed by Owner.
 1. Definition: "Each type" in the above paragraph means each unique combination of sizes (e.g. 4' or 6'), configurations (e.g. bench top or walk-in), and types (e.g. constant volume/bypass or variable volume/restricted bypass).

3.4 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

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- C. Clean adjacent construction and surfaces that may have been soiled in the course of installation of work in this Section.
- D. Protect installed fume hood as recommended by manufacturer. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure to other construction activity.

3.5 DEMONSTRATION

- A. Provide systems demonstration and demonstrate all equipment operations and functions.

END OF SECTION 115313

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SECTION 122200 - CURTAINS AND DRAPES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes draperies drapery tracks.
 - 1. Classrooms and Conference Rooms – ripplefold curtains.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Tracks: Include maximum weights of draperies that can be supported.
 - 2. Fabrics.
- B. Shop Drawings:
 - 1. Tracks: Show installation and anchorage details and locations of controls.
 - 2. Draperies: Show sizes, locations, and details of installation.
- C. Samples for Verification: As follows:
 - 1. Tracks: 18 inches long, with carriers, controls, and accessories.
 - 2. Drapery Fabrics Samples for Verification: For each color and pattern indicated, full width by 36 inches long, from dye lot to be used for the Work and with specified textile treatments applied. Show complete pattern repeat if any. Mark top and face of fabric.
 - 3. Drapery Fabrication Samples: For each heading, fabric, color, and pattern indicated, a complete full-size panel to verify details of fabrication and thread colors.

1.3 CLOSEOUT SUBMITTAL

- A. Maintenance Data: For products to include in maintenance manuals.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before drapery fabrication, and indicate measurements on Shop Drawings.
- B. Scheduling: Do not deliver or install draperies until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 - PRODUCTS

2.1 DRAPERY TRACKS

- A. Manually Operated Track:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Kirsch, 94604 trade, ripplefold installation, straight track.
 - 2. Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches o.c.
 - a. Lengths and Configurations: As indicated on Drawings.
 - b. Finish: White coating.
 - 3. Mounting Brackets: Aluminum, of type suitable for fastening track to surface indicated and designed to support weight of track assembly and drapery plus force applied to

operate track.

- a. Mounting Surface: As indicated on Drawings, recessed as indicated.
- b. Size: As indicated.
4. Installation Fasteners: Sized to support track assembly and drapery, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.
5. Operation: Baton.
 - a. Draw: One way, except as noted below.
 - b. Operating Hardware Location: Leading edge.
6. Carriers: Ripplefold.
 - a. Connected rolling swivel carrier – 7/8 inch snap type high pull force – 100% fullness.
7. End Stops: Manufacturer's standard with track end cap.

2.2 DRAPERIES

- A. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Manufacturers: Subject to compliance with requirements, provide products indicated on the finish schedule.
- C. Source Limitations: Obtain each color and pattern of drapery fabric and trim from one dye lot.

2.3 DRAPERY FABRICATION

- A. Seams: Sew vertical seams with twin-needle sewing machine with selvage trimmed and overlocked. Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are not acceptable.
- B. Side Hems: Double-turned, 1-1/2-inch- wide hems consisting of three layers of fabric, and blindstitched so that stitches are not visible on face of drapery.
- C. Bottom Hems: Double-turned, 4-inch- wide hems consisting of three layers of fabric, and weighted and blindstitched so that weights and stitches are not visible on face of drapery.
 1. Sew in square lead weights at each seam and at panel corners.

PART 3 - EXECUTION

3.1 DRAPERY TRACK INSTALLATION

- A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.
- B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

3.2 DRAPERY INSTALLATION

- A. Where draperies abut overhead construction, hang draperies so that clearance between headings and overhead construction is 1/4 inch.
- B. Extend draperies to floor, install so that bottom hems clear finished floor by not more than 1 inch and not less than 1/2 inch.

3.3 ADJUSTING

- A. After hanging draperies, test and adjust each track to produce unencumbered, smooth operation.
- B. Steam and dress down draperies as required to produce crease- and wrinkle-free installation.
- C. Remove and replace draperies that are stained or soiled.

END OF SECTION 122200

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SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with single rollers.
3. Refer to schedule at the end of this section for types and locations.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product **Manual Shades**: Subject to compliance with requirements, provide Mechoshade or comparable product by one of the following:
1. Draper Inc.
 2. Hunter Douglas Contract.
 3. Lutron.
- ~~B. Source Limitations: Obtain roller shades from single source from single manufacturer.~~
- C. **Basis-of-Design Product Motorized Shades**: Subject to compliance with requirements, provide Lutron Sivoia QS window shades.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
1. Bead Chains: Stainless Steel.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, sill mounted.
 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: Right side of inside face of shade or as indicated on the schedule.
 2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method .
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Shadebands:
1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- E. Installation Accessories:
1. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open.
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel or taping into gypsum board.

2. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
3. Endcap Covers: To cover exposed endcaps.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 - a. Electrical Characteristics: ~~Single phase, 120V, 60 Hz low voltage for connection to NFPA 70, Class 2 power source.~~
 3. ~~Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote control activation of shades:~~
 - a. ~~Keyed Control Station: Keyed, maintained contact, three position, switch-operated control station with open, close, and off functions. Provide two keys per station.~~

~~Color: As selected by Architect from manufacturer's full range.~~

3. Wired Keypads:
Lutron Architrave QS Keypads.

 - a. **Power: Class 2 (low voltage)**
 - b. **Communications: Utilize RS485 wiring for low-voltage communications link.**
 - c. **Mounting: Wallbox; Lutron Architrave Wallbox, provide wall plates with concealed mounting hardware.**
 - d. **Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.**
 - e. **Contact Closure Interface: Provide two contact closure inputs on back of unit which provide independent functions from front buttons; accepts both momentary and maintained contact closures.**
 - f. **Terminal block inputs to be over-voltage and miswire-protected against wire reversals and shorts.**
 - g. **Finish: Custom colors to be selected by Architect.**- 4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- 5. Operating Features:
 - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
 - b. Capable of interface with audiovisual control system.
 - c. Override switch.

- A. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Manufacturer's standard.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.
 - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method .
- B. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- C. Shadebands:
 - 1. Shadeband Material: As indicated in the finish legend.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As indicated in the finish legend.
- D. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches.
 - 2. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open.
 - b. Provide pocket with lip at lower edge to support acoustical ceiling panel or taping into gypsum board.

2.4 MOTOR-OPERATED, DOUBLE-ROLLER SHADES

- A. Motorized Operating Systems: Provide factory-assembled, shade-operator systems of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - 1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Electric Motor: Manufacturer's standard tubular, enclosed in rollers.
 - a. **Electrical Characteristics: Single phase, 120V, 60 Hz low voltage for connection to NFPA 70, Class 2 power source.**
 - 3. ~~Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:~~
 - a. ~~Group Control Station: Momentary contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.~~

3. **Wired Keypads: Lutron Architrave QS Keypads.**
 - b. **Power: Class 2 (low voltage)**
 - b. **Communications: Utilize RS485 wiring for low-voltage communications link.**
 - c. **Mounting: Wallbox; Lutron Architrave Wallbox, provide wall plates with concealed mounting hardware.**
 - d. **Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.**
 - e. **Contact Closure Interface: Provide two contact closure inputs on back of unit which provide independent functions from front buttons; accepts both momentary and maintained contact closures.**
 - f. **Terminal block inputs to be over-voltage and miswire-protected against wire reversals and shorts.**
 - g. **Finish: Custom colors to be selected by Architect.**
4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
5. Limit Switches: Adjustable switches, interlocked with motor controls and set to stop shade movement automatically at fully raised and fully lowered positions.
6. Operating Features:
 - a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
 - b. Capable of interface with audiovisual control system.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shades for service.
 1. Double-Roller Mounting Configuration: Side by side or vertical as indicated on shade schedule.
 2. Inside Roller:
 - a. Drive-End Location: Right side of inside face of shade.
 - b. Direction of Shadeband Roll: Regular, from back of roller.
 3. Outside Roller:
 - a. Drive-End Location: Right side of inside face of shade.
 - b. Direction of Shadeband Roll: Regular, from back of roller.
 4. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Inside Shadebands:
 1. Shadeband Material: as indicated.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
- F. Outside Shadebands:
 1. Shadeband Material: as indicated.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
3. Endcap Covers: To cover exposed endcaps.
4. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband when shade is fully open, but not less than 5 inches.
5. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recesses or pockets and for snap-in attachment to wall clip without fasteners.
 - a. Closure-Panel Width: As indicated on Drawings.

2.5 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 1. Source: Roller-shade manufacturer.
 2. Color: As indicated on Drawings.

2.6 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

SCHEDULE

Shade type 1: Levels 02-04 - motorized shades at perimeter windows in laboratories.

Locations:

Shade type: Motorized Shades - Basis of Design ~~Mecho Systems Electro Shade~~ **Lutron Sivoia QS.**

Shade Cloth: ~~EuroVeil 6450 Series Basketweave~~ - 3% open

Mounting – Top mounting, in continuous recessed pocket. ~~Pocket: 4133 w/ 2" closure.~~
Provide recessed pocket with 2 inch closure.

Operation: all shades operate together in each room **with wall mounted controller.**

Shade type 2: Level 01 – double motorized shades at perimeter window in lecture hall and conference room.

Locations: Lecture Hall 160 and Conference Room 140

Shade type: Motorized Shades - Basis of Design ~~Mecho Systems Electro Shade #1 Double Shade. #13 Lutron Sivoia QS.~~

Shade Cloth: Top Roll, Outside Roll: ~~EuroVeil 6450 Series Basketweave~~ (3% open); Bottom Roll, Inside Roll: **Match Mecho Systems** Equinox Blackout 0100 Series (0% open)

Mounting – Top mounting

Operation: Outside shade and inside shade must be capable of operating independently.

Stagger shades so that the inside shade covers gaps at the outside shade. Align gaps at outside shade with mullions. In lecture hall shades to be operable from two locations.

~~**Alternate Bid for Shade Type 2: Provide Alternate Bid for Lutron Low voltage shades for these rooms.**~~

Shade type 3: Level 02-04 single manual shades at perimeter windows in offices and prep rooms.

Locations: where noted on ceiling plans

Shade type: Manual Shades - Basis of Design Mecho Systems Manual Shade – Mecho/5 Bracket

Shade Cloth: EuroVeil 6450 Series – 3% open

Mounting – Top mounting, in continuous recessed pocket. Pocket: 4133 w/ 2" closure.

Configuration: Align shade gaps with mullions. No battens. One shade per glass area between mullions. Provide lift assist mechanism if required by size of shade, on side opposite of door opening.

Shade type 4: Level 03 single manual shades at perimeter windows in offices with sloped perimeter ceiling: mounted in pocket.

Locations: where noted on ceiling plans

Shade type: Manual Shades - Basis of Design Mecho Systems Manual Shade – Mecho/5 Bracket

Shade Cloth: EuroVeil 6450 Series – 3% open

Mounting – Top mounting, in continuous “freestanding” pocket supported by painted 4” x 4” x 1/4” steel angle spanning across room. Pocket: 4133 w/ 2” closure.

Configuration: Align shade gaps with mullions. No battens. One shade per glass area between mullions. Provide lift assist mechanism if required by size of shade.

Shade type 5: Level 02– double motorized shades at perimeter window in classrooms – mounted in recessed pocket

Locations: **Lecture Hall 160 and Conference Room 140 Classrooms 231 & 233 and Open Lab 235.**

Shade type: Motorized Shades - Basis of Design ~~Mecho Systems Electro /3 Double Shade- #20 Lutron Sivoia QS double shade~~ with fascia. Shades are set side by side in a parallel configuration.

Shade Cloth: Top Roll, Outside Roll: ~~EuroVeil 6450 Series Basket weave~~ (3% open); Bottom Roll, Inside Roll: ~~Equinox Blackout 0100 Series~~ 0% open **to match MechoShade Equinox.**

Mounting – Top mounting

Operation: Outside shade and inside shade must be capable of operating independently.

Stagger shades so that the inside shade covers gaps at the outside shade. Align gaps at outside shade with mullions.

Alternate Bid for Shade Type 5: Provide Alternate Bid for Lutron Low voltage shades for these rooms.

Shade type 6: Levels 02 and 03 manual shade at interior glazing in laboratories

Location: Laboratories where noted.

Shade type: Manual Shades - Basis of Design Mecho Systems Manual Shade – Mecho/5 Bracket Shade Cloth: EuroVeil 5300 Series (5% open)

Mounting – Top mounting, in continuous recessed pocket. Provide 3” Pocket closure.

Operation: Locate chain operators on side opposite of door opening.

Shade type 7: Level 02 and Level 04 double motorized shades at projected windows in laboratories.

Locations: as noted on drawings

Shade type: Motorized Shades - Basis of Design ~~Mecho Systems Electro /3 Double Shade- #20 Lutron Sivoia QS double shade~~ with fascia. Shades are set side by side in a parallel configuration.

Shade Cloth: Outside Roll: ~~EuroVeil 6450 Series Basketweave~~ (3% open); Inside Roll: ~~Equinox Blackout 0100 Series~~ 0% open **to match MechoShade Equinox.**

Mounting – Top mounting with continuous fascis.

Operation: Outside shade and inside shade must be capable of operating independently.

Stagger shades so that the inside shade covers gaps at the outside shade. Align gaps at outside shade with mullions.

Shade type 8: Level 02 double motorized shades at SCIN Classroom in recessed pocket.

Locations: Room 276 SCIN Classromm

Shade type: Motorized Shades - Basis of Design Basis of Design Mecho Systems Electro Shade #1 Double Shade. #13

Shade Cloth: Top Roll, Outside Roll: ~~EuroVeil 6450 Series Basketweave~~ (3% open); Inside Roll: ~~Equinox Blackout 0100 Series~~ 0% open **to match MechoShade Equinox**

Mounting: Top mounting with continuous recessed pocket..

Operation: Outside shade and inside shade must be capable of operating independently.

Stagger shades so that the inside shade covers gaps at the outside shade. Align gaps at outside shade with mullions.

~~**Alternate Bid for Shade Type 8: Provide Alternate Bid for Lutron Low voltage shades for these rooms.**~~

END OF SECTION 122413

SECTION 123553 - LABORATORY CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal laboratory casework.
2. Wood laboratory casework.
3. Utility-space framing at backs of base cabinets and between backs of base cabinets.
4. Filler and closure panels.
5. Laboratory casework system that includes support and utility-space framing, filler and closure panels, wall panels, undercabinet lighting, and modular countertops.
6. Laboratory countertops.
7. Gas cylinder storage cabinets.
8. Tables.
9. Shelves.
10. Laboratory sinks.
11. Laboratory accessories.
12. Water, laboratory gas, and electrical service fittings.

1.2 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or behind glass doors.
1. Ends of cabinets, including those installed directly against walls or other cabinets, are defined as "exposed."
- C. Semiexposed Surfaces of Casework: Surfaces behind opaque doors, such as cabinet interiors, shelves, and dividers; interiors and sides of drawers; and interior faces of doors. Tops of cabinets 78 inches or more above floor are defined as "semiexposed."
- D. Concealed Surfaces of Casework: Include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.
- E. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive and faced both front and back with hardwood veneers.

1.3 PERFORMANCE REQUIREMENTS

- A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:
1. Support Framing System: 600 lb/ft..
 2. Suspended Base Cabinets (Internal Load): 160 lb/ft..
 3. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft..
 4. Wall Cabinets (Upper Cabinets): 160 lb/ft..
 5. Shelves: 40 lb/sq. ft..
- B. Delegated Design: Design laboratory casework, including comprehensive engineering analysis by a qualified professional engineer, using seismic performance requirements and design criteria indicated.

- C. Seismic Performance: Laboratory casework and support framing system, including attachments to other work, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
- D. ***All components for casework and tables containing electrical wiring and devices shall be labeled and approved by UL. (Add 3-3)***

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
 - 1. Certificates for Credit MR 6 and Credit MR 7: Chain-of-custody certificates certifying that cabinets, countertops, and shelves comply with forest certification requirements. Include evidence that casework manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
 - 2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
- C. Shop Drawings: For laboratory casework. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate locations of hardware and keying of locks.
 - 2. Indicate locations and types of service fittings.
 - 3. Indicate locations of blocking and reinforcements required for installing laboratory casework.
 - 4. Include details of utility spaces showing supports for conduits and piping.
 - 5. Include details of support framing system.
 - 6. Include details of exposed conduits, if required, for service fittings.
 - 7. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
 - 8. Include coordinated dimensions for laboratory equipment specified in other Sections.
- D. Samples for Initial Selection: For factory-applied finishes and other materials requiring color selection.
- E. Samples for Verification: For each type of cabinet finish and each type of countertop material indicated, in manufacturer's standard sizes.
- F. Samples for Verification: Unless otherwise directed, approved full-size Samples may become part of the completed Work, if in an undisturbed condition at time of Substantial Completion. Notify Architect of their exact locations. If not incorporated into the Work, retain acceptable full-size Samples at Project site and remove when directed by Architect.
 - 1. One full-size, finished base cabinet complete with hardware, doors, and drawers.
 - 2. One full-size, finished wall cabinet complete with hardware, doors, and adjustable shelves.
 - 3. One Sample each of hinged and sliding doors.
 - 4. 6-inch-square Samples for each type of countertop material.
 - 5. One of each service fitting specified, complete with accessories and specified finish.
 - 6. One of each type of sink and accessory item specified.
 - 7. One of each type of hardware item specified.
- G. Delegated-Design Submittal: For laboratory casework indicated to comply with seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified manufacturer.

- B. Product Test Reports for Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard and system structural performance specified in "Performance Requirements" Article.
- C. Product Test Reports for Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface materials with requirements specified for chemical and physical resistance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish complete touchup kit for each type and color of metal laboratory casework provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.
- B. Furnish complete touchup kit for each type and color of wood laboratory casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.
- C. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Cabinet Mounting Clips and Related Hardware: Quantity equal to 5 percent of amount installed, but no fewer than 20 of each type.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA 8 and is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.
 - 1. Obtain countertops, sinks, accessories, and service fittings from casework manufacturer.
- C. Product Designations: Drawings indicate sizes and configurations of laboratory casework.
- D. Casework Product Standard: Comply with SEFA 8, "Laboratory Furniture - Casework, Shelving and Tables - Recommended Practices."
- E. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction, FM Approvals. Provide wood cabinets with self closing doors, wood finish to match adjacent wood cabinets.
- F. 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.
- G. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.
- H. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet work are complete and dry, and temporary HVAC system

is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.

PART 2 - PRODUCTS

2.1 METAL CABINET AND TABLE MATERIALS

- A. Metal: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.
- B. Nominal Metal Thickness:
 - 1. Sides, Ends, Fixed Backs, Bottoms, Tops, Soffits, and Items Not Otherwise Indicated: 0.048 inch. Except for flammable liquid storage cabinets, bottoms may be 0.036 inch if reinforced.
 - 2. Back Panels, Doors, Drawer Fronts and Bodies, and Shelves: 0.036 inch except 0.048 inch for back panels and doors of flammable liquid storage cabinets and for unreinforced shelves more than 36 inches long.
 - 3. Intermediate Horizontal Rails, Table Aprons and Cross Rails, Center Posts, and Top Gussets: 0.060 inch.
 - 4. Drawer Runners, Sink Supports, and Hinge Reinforcements: 0.075 inch.
 - 5. Leveling and Corner Gussets: 0.105 inch.
- C. Wood Door and Drawer Front Materials:
 - 1. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
 - 2. Wood Species: White Oak.
 - a. Cut: Rift cut/rift sawn.
 - b. Grain Direction: Horizontal.
 - c. Matching of Veneer Leaves: Book match.
 - 3. Certified Wood Materials: Provide wood door and drawer fronts obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 - 4. Adhesives: Adhesives shall not contain urea formaldehyde.
 - 5. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core, unless otherwise indicated, made without urea formaldehyde with face veneer of species indicated, selected for compatible color and grain. Grade AA exposed faces at least 1/50 inch thick, and Grade J crossbands. Provide backs of same species as faces.
 - a. Particleboard: ANSI A208.1, Grade M-2.
 - b. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
 - 6. Solid Wood: Clear hardwood lumber of species indicated, selected for compatible grain and color, with moisture content not more than 7 percent.
 - 7. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch- thick, solid wood of same species as face veneer.
 - a. Colors: Match Architect's samples.

2.2 WOOD CABINET, **STORAGE CUBES**, AND TABLE MATERIALS (**Add 3-1**)

- A. General:

1. Certified Wood Materials: Provide cabinets with not less than 70 percent of all wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
2. Adhesives: Adhesives shall not contain urea formaldehyde.
3. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core, unless otherwise indicated, made without urea formaldehyde.
4. MDF: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
5. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
6. Hardboard: AHA A135.4, Class 1 Tempered.
7. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch- thick, solid wood of same species as face veneer.
 - a. Colors: Match Architect's samples.

B. Exposed Materials:

1. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
2. Wood Species: White Oak.
 - a. Cut: Rift cut/rift sawn.
 - b. Grain Direction: Horizontal.
 - c. Matching of Veneer Leaves: Book match.
3. Plywood: Hardwood plywood with face veneer of species indicated, selected for compatible color and grain. Grade AA exposed faces at least 1/50 inch thick, and Grade J crossbands. Provide backs of same species as faces.
4. Solid Wood: Clear hardwood lumber of species indicated, selected for compatible grain and color.

C. Semiexposed Materials:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of same species as exposed solid wood.
2. Plywood: Hardwood plywood of same species as exposed plywood. Grade B faces and Grade J crossbands. Provide backs of same species as faces.
3. Provide solid wood or hardwood plywood for semiexposed surfaces unless otherwise indicated.

D. Concealed Materials:

1. Solid Wood: Any species, with no defects affecting strength or utility.
2. Plywood: Hardwood plywood. Provide backs of same species as faces.
3. Particleboard.
4. MDF.
5. Hardboard.

2.3 AUXILIARY CABINET MATERIALS

- A. Acid Storage-Cabinet Lining: 1/4-inch- thick, polyethylene or polypropylene.
- B. Glass for Glazed Doors: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.

2.4 COUNTERTOP TABLE TOP, SHELF, AND SINK MATERIALS

- A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Durcon Company (The).
 - b. Epoxyn Products.
 - c. Laboratory Tops, Inc.
 - d. Prime industries, Inc.
 2. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 psi.
 - b. Modulus of Elasticity: Not less than 2,000,000 psi.
 - c. Hardness (Rockwell M): Not less than 100.
 - d. Water Absorption (24 Hours): Not more than 0.02 percent.
 - e. Heat Distortion Point: Not less than 260 deg F.
 3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
 - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
 4. Color: As selected by Architect from manufacturer's full range.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 316L.

2.5 METAL CABINETS AND TABLES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Kewaunee Scientific Corporation; Laboratory Products Group or one of the following:
1. Jamestown Metal Products.
 2. Lab Crafters, Inc.
- B. Fabrication: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch.
- C. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.
- D. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.
- E. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.
- F. Drawers: Fronts made from outer and inner pans that nest into box formation, with no raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal. Provide drawers with rubber bumpers, polymer roller slides, and positive stops to prevent metal-to-metal contact or accidental removal.
- G. Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.
- H. Toe Space: Fully enclosed, 4 inches high by 3 inches deep, with no open gaps or pockets.
- I. Tables: Welded tubing legs, not less than 2 inches square with channel stretchers as needed to comply with product standard. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device welded to bottom of each leg.

1. Leg Shoes: Satin-finished stainless steel, open-bottom, slip-on type.
- J. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies.
 1. Provide base cabinets with removable backs for access to utility space.
- K. Utility-Space Framing: Laboratory casework manufacturer's standard steel framing units consisting of 2 steel slotted channels complying with MFMA-4, not less than 1-5/8 inches square by 0.105-inch nominal thickness, and connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch steel flat bars. Framing units may be made by welding specified channel material into rectangular frames instead of using U-shaped brackets.
- L. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets and with hemmed or flanged edges unless otherwise indicated.
 1. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
 2. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
 3. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed. Fabricate from back-to-back panels or of hollow construction to eliminate exposed hemmed or flanged edges.

2.6 WOOD CABINETS, **STORAGE CUBES**, AND TABLES (*Add 3-1*)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Kewaunee Scientific Corporation; Laboratory Products Group or comparable product by one of the following:
 1. Advanced Lab Concepts, Inc.
 2. CampbellRhea.
 3. Collegedale Casework, LLC.
- C. Design: Flush overlay.
 1. Provide 1/16-inch reveals between doors and drawers that are adjacent.
- D. Grain Direction:
 1. Horizontal on both doors and drawer fronts, with continuous matching.
 2. Lengthwise on face frame members.
 3. Vertical on end panels.
 4. Side to side on bottoms and tops of units.
 5. Vertical on knee-space panels.
 6. Horizontal on aprons and table frames.
- E. Veneer Matching:
 1. Provide veneers for each elevation from a single flitch, slip matched.
 - a. Provide continuous matching of adjacent drawer fronts within each cabinet and end matching between drawer fronts of adjacent cabinets.
- F. Construction: Provide wood-faced laboratory casework of the following minimum construction:
 1. Bottoms of Base Cabinets and Tall Cabinets: 3/4-inch- thick veneer-core hardwood plywood.

2. Tops and Bottoms of Wall Cabinets and Tops of Tall Cabinets: 1-inch- thick veneer-core hardwood plywood.
 3. Ends of Cabinets: 3/4-inch- thick hardwood plywood.
 4. Shelves: 1-inch- thick veneer-core hardwood plywood.
 5. Base Cabinet Top Frames: 3/4-by-2-inch solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
 6. Base Cabinet Stretchers: 3/4-by-4-1/2-inch panel product strips or solid wood boards at front and back of cabinet, glued and pinned or screwed.
 7. Base Cabinet Subtops: 3/4-inch-thick panel product glued and pinned or screwed.
 8. Backs of Cabinets: 3/4-inch- thick, particleboard- or MDF-core hardwood plywood where exposed, dadoed into sides, bottoms, and tops where not exposed.
 9. Drawer Fronts: 3/4-inch- thick, particleboard- or MDF-core hardwood plywood or solid hardwood.
 10. Drawer Sides and Backs: 1/2-inch- thick, solid hardwood or veneer-core hardwood plywood, with glued dovetail or multiple-dowel joints.
 11. Drawer Bottoms: 1/4-inch- thick, veneer-core hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch- thick material for drawers more than 24 inches wide.
 12. Doors 48 Inches High or Less: 3/4 inch thick, with particleboard or MDF cores and hardwood face veneers and crossbands.
 13. Doors More Than 48 Inches High: 1-1/8 inches thick, with particleboard cores and hardwood face veneers and crossbands.
 14. Stiles and Rails of Glazed Doors 48 Inches High or Less: 3/4-inch- thick, solid hardwood.
 15. Stiles and Rails of Glazed Doors More Than 48 Inches High: 1-1/16-inch- thick, solid wood with hardwood face veneers.
- G. Tables: Solid hardwood legs, not less than 2 inches square with solid hardwood stretchers as needed to comply with product standard. Bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device at bottom of each leg.
1. Leg Shoes: Black rubber, open-bottom, slip-on type.
- H. Utility-Space Framing: Laboratory casework manufacturer's standard steel framing units consisting of 2 steel slotted channels complying with MFMA-4, not less than 1-5/8 inches square by 0.105-inch nominal thickness, and connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch steel flat bars. Framing units may be made by welding specified channel material into rectangular frames instead of using U-shaped brackets.
- I. Filler and Closure Panels: Provide where indicated and as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as adjacent exposed cabinet surfaces unless otherwise indicated.
1. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
 2. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.
 3. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed. Fabricate from same material and with same finish as exposed cabinet backs.

2.7 **MOBILE/ADAPTIBLE** LABORATORY CASEWORK SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kewaunee Scientific Corporation; **Alpha System Laboratory Product Group** or comparable product by one of the following:
1. Jamestown Metal Products.
- B. Provide casework manufacturer's standard integrated **mobile cart** system that includes support framing, suspended modular cabinets, filler and closure panels, wall panels, undercabinet task-

lighting fixtures, countertops, and fittings needed to assemble system. System includes hardware and fasteners for securing support framing to permanent construction.

1. Cabinet Construction: Wood.
 2. Cabinets can be removed and reinstalled without use of special tools for relocation within system.
 3. Base cabinets can be removed without providing temporary support for, or removing, countertops.
 4. Sinks are supported independent of base cabinets.
 5. Support framing has provision for fastening pipe supports at utility space in not more than 1-inch increments, **where located at walls**.
 6. System includes filler and closure panels to close spaces between support framing, cabinets, shelves, countertops, floors, and walls unless otherwise indicated. Fabricate panels from same material and with same finish as metal cabinets and with hemmed or flanged edges.
- C. Support Framing: Casework manufacturer's standard system consisting of vertical **and horizontal framing** supports and connecting braces and rails as follows:
1. Cabinets, shelves, and countertops are supported from vertical supports except where floor-supported base cabinets are indicated. Vertical positioning of supported cabinets, shelves, and countertops can be varied in 1-inch increments through full height of supports.
 2. Vertical supports rest on adjustable leveling bases and are secured to floor with metal clips fastened to floor.
 3. Vertical supports are installed with braces and rails connecting them to each other and to permanent building walls to create a stable, rigid structure with framed utility spaces where indicated.
 4. **Supports and associated framing must pass UL 962 Anti-tip Test.**
- D. Undercabinet Task-Light Fixtures: ~~LED fixtures with switch and heavy-duty cord and plug and occupancy sensor. Refer to Division 26 Sections and electrical drawings.~~
- ~~1. Finish: Baked enamel.~~
 - ~~2. Diffusers: Virgin acrylic with high resistance to yellowing and other changes due to aging, heat, and UV radiation.~~
 - ~~3. Ballast Sound Rating: A.~~
- E. Countertops: Provide in modular lengths indicated, without seams.

2.8 METAL SHELVING SYSTEM

- A. **Provide wall mounted adjustable shelves mounted on double slotted standards in sizes as shown on drawings.**
- B. **Provide mobile laboratory casework shelves mounted on system verticals in sizes as shown on drawings.**
- C. **Adjustable shelves must be interchangeable between wall mounted systems and mobile laboratory casework systems.**
- D. **Provide upturned side brackets at all shelves.**
- E. **Provide intermediate shelves at all mobile casework.**
- F. **Provide 3/8 inch diameter stainless steel bar earthquake lips on all shelves. Maximum unsupported span of 3 feet.**
 1. **Wall mounted shelves: Locate earthquake lips on front of each shelf and at exposed sides if upturned side bracket does not exist.**

2. ***Mobile laboratory casework mounted shelves: Locate earthquake lips on front of each shelf and exposed sides if either upturned side bracket does not exist or it is turned down as in top shelves. Refer to drawings.***
3. ***All shelves, standards, and brackets shall be white to match fume hood color.***

2.9 CYLINDER GAS CABINETS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Safety Equipment Corporation; 7000 series or comparable product approved by the Architect.
 1. Model 7200 – 2-cylinder
 2. Model 7300 – 3-cylinder
- B. All welded construction using 11-gauge steel, epoxy painted. Texture finish on outside, smooth finish on inside of cabinet.
- C. Exhaust vent located on top of cabinet is 6 inch diameter X 3 inches high.
- D. Cylinder bracket accommodates 7 inch to 10 inch diameter cylinders. The brackets are adjustable for precise pig-tail alignment. Verify with Owner prior to ordering.
- E. Door and window will close and latch automatically.
- F. Window is 1/4 inch thick clear wire glass.
- G. Louvers at bottom of door.
- H. Flush mounted stainless steel paddle latch.
- I. All stainless steel fasteners.

2.10 METAL CABINET FINISH

- A. General: Prepare, treat, and finish welded assemblies after assembling. 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: After assembly, clean surfaces 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 laboratory casework 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 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
 2. Colors for Metal Laboratory Casework Finish: Match Architect's samples.

2.11 WOOD FINISH

- A. Preparation: Sand lumber and plywood before assembling. Sand edges of doors, drawer fronts, and molded shapes with profile-edge sander. Sand after assembling for uniform smoothness at least equivalent to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.
- B. Staining: Remove fibers and dust and apply stain to exposed and semiexposed surfaces as necessary to match approved Samples. Apply stain in a manner that will produce a consistent appearance. Apply wash-coat sealer before applying stain to closed-grain wood species.
 1. Stain Color: Match Architect's samples.

- C. Chemical-Resistant Finish: Apply laboratory casework manufacturer's standard three-coat, chemical-resistant, transparent finish. Sand and wipe clean between coats. Topcoat(s) may be omitted on concealed surfaces.
 - 1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.

2.12 HARDWARE

- A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.
- B. Hinges: Stainless-steel, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 48 inches high or less and 3 for doors more than 48 inches high.
- C. Hinged Door and Drawer Pulls: Stainless steel back-mounted pulls. Provide 2 pulls for drawers more than 24 inches wide.
 - 1. Design: Wire pulls as selected from manufacturer's full range.
 - 2. Overall Size: As selected from manufacturer's full range.
- D. Door Catches: Nylon-roller spring catches. Provide 2 catches on doors more than 48 inches high.
- E. Drawer Slides: Side mounted, epoxy-coated steel, self-closing; designed to prevent rebound when drawers are closed; complying with BHMA A156.9, Type B05091.
 - 1. Provide Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
 - 2. Provide Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
 - 3. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Full-overtravel-extension, ball-bearing type.
- F. Label Holders: Stainless steel; sized to receive standard label cards approximately 1 by 2 inches, attached with screws or rivets. Provide where indicated.
- G. Locks for Metal Cabinets: Cam or half-mortise type with 5-pin tumbler, brass with chrome-plated finish; complying with BHMA A156.11, Type E07281, E07261, E07111, or E07021.
 - 1. Provide a minimum of two keys per lock and two master keys.
 - 2. Provide where indicated.
 - 3. Keying: Key locks as directed.
 - 4. Master Key System: Key all locks to be operable by master key.
- H. Locks for Wood Cabinets: Cam type with 5-pin tumbler, brass with chrome-plated finish; complying with BHMA A156.11, Type E07281.
 - 1. Provide a minimum of two keys per lock and two master keys.
 - 2. Provide where indicated.
 - 3. Keying: Key locks as directed.
 - 4. Master Key System: Key all locks to be operable by master key.
- I. Sliding-Door Hardware Sets: Laboratory casework manufacturer's standard, to suit type and size of sliding-door units.
- J. Adjustable Shelf Supports for Wood Cabinets: Mortise-type, powder-coated steel standards and shelf rests complying with BHMA A156.9, Types B04071 and B04091.
- K. Adjustable Wall Shelf Supports: Surface-type steel standards and steel shelf brackets, with epoxy powder-coated finish, complying with BHMA A156.9, Types B04102 and B04112. ***Wall standards to have the same general performance requirements as frame assemblies for adjustable mobile casework.***

2.13 COUNTERTOPS, TABLE TOPS, SHELVES AND SINKS

- A. Countertops, General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch, with continuous drip groove on underside 1/2 inch from edge.
- B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.
 - 1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2, unless otherwise indicated.
 - 2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches less than sink depth. Provide in same material as strainer.
- C. Epoxy Countertops, Table Tops, and Sinks:
 - 1. Countertop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and with butt joints assembled with epoxy adhesive and concealed metal splines.
 - a. Countertop Configuration: Flat, 1 inch thick, with beveled edge and corners, and with drip groove and applied backsplash unless otherwise noted.
 - b. Countertop Configuration: Raised (marine) edge, 1-inch minimum thickness, with integral or applied raised edge having beveled edge and corners, and with applied backsplash.
 - c. Countertop Construction: Uniform throughout full thickness.
 - 2. Table-Top Fabrication:
 - a. Table-Top Configuration: Flat, 1 inch thick, with beveled edge and corners, and with drip groove at perimeter.
 - b. Table-Top Construction: Uniform throughout full thickness.
 - 3. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch minimum thickness.
 - a. Provide with polypropylene strainers and tailpieces.
 - b. Provide sinks for drop-in installation with 1/4-inch- thick lip around perimeter of sink.
 - c. Provide manufacturer's recommended adjustable support system for table- and cabinet-type installations.
- D. Stainless-Steel Countertops: Made from stainless-steel sheet, not less than 0.062-inch nominal thickness, with No. 4 satin finish.
 - 1. Extend top down 1 inch at edges with a 1/2-inch return flange under frame. Apply heavy coating of heat-resistant, sound-deadening mastic to undersurface.
 - 2. Form backsplash coved to and integral with top surface.
 - 3. Punch holes for service fittings at factory.
 - 4. Reinforce underside of countertop with channels or use thicker metal sheet where necessary to insure rigidity without deflection.
 - 5. Weld shop-made joints.
 - 6. Where field-made joints are required, provide hairline butt-joints mechanically bolted through continuous channels welded to underside at edges of joined ends. Keep field jointing to a minimum.
 - 7. Where stainless-steel sinks or cup sinks occur in stainless-steel countertops, factory weld into one integral unit.
 - 8. After fabricating and welding, grind surfaces smooth and polish as needed to produce uniform, directionally textured finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.

- E. Stainless-Steel Shelves: Made from stainless-steel sheet, not less than 0.050-inch nominal thickness, with No. 4 satin finish. Weld shop-made joints. Fold down front edge 3/4 inch; fold up back edge 3 inches. Provide integral stiffening brackets, formed by folding up ends 3/4 inch and welding to upturned back edge. After fabricating, grind welds smooth and polish as needed to produce uniform, directionally textured finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.
- F. Stainless-Steel Sinks: Made from stainless-steel sheet, not less than 0.050-inch nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch radius. Slope sink bottoms to outlet. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2-inch diameter. Provide continuous butt-welded joints. After fabricating and welding, grind surfaces smooth and polish as needed to produce uniform finish with no evidence of welds and free of cross scratches. Passivate and rinse surfaces; remove embedded foreign matter and leave surfaces clean.
 - 1. Punch holes for fittings at factory.
 - 2. Provide with stainless-steel strainers and tailpieces.
 - 3. Provide with integral rims except where located in stainless-steel countertops.
 - 4. Apply 1/8-inch- thick coating of heat-resistant, sound-deadening mastic to undersink surfaces.
- G. Cup Sinks: Epoxy, 3-by-6-inch oval and 3-by-9-inch oval.
 - 1. Provide with polypropylene strainers and integral tailpieces.

2.14 LABORATORY ACCESSORIES

- A. Reagent Shelves: Provide as indicated, fabricated from same material as adjacent countertop, unless otherwise indicated. Provide stainless steel round earthquake lips at all shelves on all sides.
- B. Burette Rods: Stainless-steel rods, 1/2 inch in diameter and 18 inches long, threaded on 1 end to fit tapered plug adapter for flush socket receptacle. Provide with tapered plug adapter and receptacle.
- C. Upright Rod Assembly and Metal Crossbar: Stainless steel. Two vertical rods and 1 horizontal crossbar, 3/4 inch in diameter and 36 inches long, unless otherwise indicated; 2 flush socket receptacles and 2 crossbar clamps. Ends of vertical rods are tapered to fit receptacles; all other rod ends are rounded.
- D. Greenlaw Arm Assembly: Stainless-steel vertical rod, tapered on one end to fit flush socket receptacle. Adjustable crossbar of hardwood with black, acid-resistant finish, secured to upright with adjustable clamp. Provide with receptacle.
- E. Lattice Assembly: Stainless-steel, vertical and horizontal rod lattice assembly with 3/4-inch-diameter rods at approximately 12 inches o.c. with 2 flush socket receptacles for mounting.
 - 1. Size: refer to drawings.
- F. Pegboards: Epoxy, pegboards with removable polypropylene pegs and epoxy drip troughs with drain outlet and tubing to the sink.

2.15 WATER AND LABORATORY GAS SERVICE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Broen-**Lab** A/S (Basis-of-Design).
 - 2. WaterSaver Faucet Co.
- B. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures - Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other

installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

1. Provide units that comply with "Vandal-Resistant Faucets and Fixtures" recommendations in SEFA 7.
- C. Materials: Fabricated from cast or forged red brass unless otherwise indicated.
 1. Reagent-Grade Water Service Fittings: Polypropylene, PVC, or PVDF for parts in contact with water.
- D. Finish: Acid- and solvent-resistant powder coating complying with requirements in SEFA 7 for corrosion-resistant finishes.
 1. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard white.
- E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig.
 1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
 2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
 3. Self-Closing Valves: Provide self-closing valves where indicated.
- F. Ground-Key Cocks: Tapered core and handle of one-piece forged brass, ground and lapped, and held in place under constant spring pressure. Provide units designed for working pressure up to 40 psig, with serrated outlets.
- G. Ball Valves: Chrome-plated ball and PTFE seals. Handle requires no more than 5 lbf to operate. Provide units designed for working pressure up to 75 psig, with serrated outlets.
 1. Where ball valves are indicated for fuel-gas use, provide locking safety handles that must be pushed in or pulled up before being turned on unless otherwise indicated.
- H. Steam Valves: Stainless-steel seat and PTFE seat disc. Provide units designed for steam working pressure up to 20 psig, with serrated outlets.
- I. Needle Valves: Provide units with renewable, self-centering, floating cones and renewable seats of stainless steel or Monel metal, with removable serrated outlets.
 1. Provide units designed for working pressure up to 125 psig.
- J. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."
- K. Remote-Control Valves: Provide needle valves, straight-through or angle type as indicated for fume hoods and where indicated.
- L. Handles: Provide three- or four-arm, forged-brass or three- or four-wing, powder-coated metal handles for valves unless otherwise indicated.
 1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
 2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
 3. Provide heat-resistant plastic handles for steam valves.
 4. Provide knurled, molded plastic handles for needle valves.
- M. Service-Outlet Identification: Provide color-coded plastic discs with embossed identification, secured to each service-fitting handle to be tamper resistant. Comply with SEFA 7 for colors and embossed identification.

2.16 ELECTRICAL SERVICE FITTINGS

- A. Service Fittings, General: Provide units complete with metal housings, receptacles, terminals, switches, pilot lights, device plates, accessories, and gaskets required for mounting on laboratory casework.
- B. Receptacles: Comply with NEMA WD 1, NEMA WD 6, and UL 498. Duplex type, Configuration 5 20R.
 - 1. Receptacle Grade: Generalgrade unless otherwise indicated.
 - 2. Color of Receptacles: White unless otherwise indicated or required by NFPA 70.
 - 3. GFCI Receptacles: Straight blade, feed-through or non-feed-through type. Comply with UL 943, Class A, General grade, and include indicator light that is lighted when device is tripped.
 - 4. TVSS (Transient Voltage Surge Suppressor) Receptacles: Comply with UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
 - a. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and a minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 - b. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
 - c. Receptacle Type: Generalgrade, with isolated-ground terminal.
 - d. Identification: Distinctive marking on face of device to denote TVSS-type unit.
 - e. Color of TVSS Receptacles: Blue.
- C. Switches: Comply with NEMA WD 1 and UL 20. Provide single-pole, double-pole, or 3-way switches as required; rated 120 to 277-V ac; and in amperage capacities to suit units served.
 - 1. Color of Switches: White unless otherwise indicated or required by NFPA 70.
 - 2. Provide pilot light adjacent to switch or neon-lighted handle, illuminated when switch is "ON," where noted as "PL" next to switch identification.
 - 3. Provide key-operated switch where noted as "KEY" next to switch identification.
 - 4. Provide thermal-overload switches, single or double pole, as required, with maximum overcurrent trip setting to suit particular motor controlled.
- D. Pedestal-Type Fittings: Cast-aluminum housings with sloped single face or two faces, as indicated, with neoprene gasket under base and with concealed mounting holes in base for attaching to laboratory casework. Provide holes tapped for conduits.
- E. Line-Type Fittings: Provide with cast-metal boxes with threaded holes for mounting on rigid steel conduit. Provide cover plates same size as boxes.
- F. Recessed-Type Fittings: Provide with galvanized-steel boxes.
- G. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal- and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by Architect from manufacturer's full range.
- H. Cover Plates: Provide white cover plates with formed, beveled edges.
- I. Cover-Plate Identification: Use 1/4-inch- high letters unless otherwise indicated. For stainless steel or chrome-plated metal, stamp or etch plate and fill in letters with black enamel.
 - 1. Provide at the following locations:
 - a. Receptacles other than standard 125-V duplex, grounding type.
 - b. Switches and thermal-overload switches.
 - c. Pilot lights when located remotely from associated equipment or switch, where function is not obvious.
 - d. Receptacles, switches, and other locations indicated.
 - 2. Provide the following information:

- a. Voltage and phase for receptacles other than standard 125-V duplex, grounding type.
- b. Indicate equipment being controlled by switches and thermal-overload switches.
- c. Indicate equipment being controlled for pilot lights when located remotely from associated equipment or switch, where function is not obvious.
- d. Number of breaker in panelboard that controls device.

2.17 LOCAL EXTRACTORS

- A. Product: Subject to compliance with the requirements, provide products by one of the following manufacturers:
 1. Movex Inc.; "Terfu Local Extractor, Model Ceiling Mount MT 1650-100 with Ceiling Bracket MTI" (Basis-of-Design).
 2. Alsident Systems.
 3. Fisher Hamilton L.L.C.
 4. Enviroflex International, Inc.
- B. General: Local extractor with articulating joints, suitable for evacuation of airborne contaminants.
- C. Construction:
 1. Anodized aluminum tubes with air-tight dampers.
 2. Ball-bearing supported adjustable friction joints in polypropylene with guide rings of low friction treated rubber.
 - a. Number: 3 joints per unit.
 3. Size: 4 inch diameter.
 4. Air Movement: 270 CFM.
 5. Hoods: Dome type.
 6. Mounting: Ceiling.
 7. Temperature Operating Range: -5 degrees F to 176 degrees F.

2.18 RADIUSSED OVERHEAD SERVICE CARRIER

- A. System Design Description: Horizontal service chase tied into the ceiling deck and suspended below the ceiling deck or ceiling suspended t-grid system. Carrier body serves as service \ chase for cabling, plumbing, electrical conduit, light fixtures and localized exhaust ductwork.
- B. System requirements:
 1. Independently supported overhead storage components.
 2. Modules designed to distribute utilities, communications, exhaust, electrical data/voice and lighting as shown on drawings.
 3. Modular units linked in tandem for a continuous service run.
 4. Horizontal chase supplied with quick connects and disconnects for mobile bench and/or equipment rack applications. Quick connects fixtures use a keyed, color-coded lock system to prevent wrong connections.
 5. Service carrier can be suspended at any height above specified work surface to free workspace of service fixtures, electrical and data outlets.
 6. Support structure design uses standard strut components and hardware.
- C. Overhead Service Carrier:
 1. Fabricate carrier body and access covers from 16-gauge cold rolled steel.

2. Incorporate UL approved, factory installed junction boxes for electrical and data outlets. Set junction boxes flush to the exterior of the carrier body.
 3. Incorporate factory punched and plugged service ports.
 4. Field install service fixtures, electrical and data outlets.
 5. Construct exhaust system of 3" PVC duct collar that fasteners to carrier body to accept extraction device.
 6. Intersection Assembly: Vacuum formed from chemically resistant acrylic PVC thermoplastic sheets. Mold assembly to follow the radiused profile of the carrier body. Provide universal intersection assembly that accommodates 2 way, 3 way and 4 way connections with same module.
- D. Heavy-Duty Umbilical Uprights: Support structures for umbilical service chase and structural member between carrier bodies the ceiling plenum.
1. Umbilical Chase: Incorporate support members that use standard pipe and conduit supports.
 2. Umbilical Side and End Panels: Fastened by a keyhole slot with mechanical fasteners.
- E. Carrier Body: Modular units suitable for floor-mounted cabinets, freestanding tables and mobile equipment racks. Gang carrier bodies side-to-side in a continuous run, and join with splice joint assembly. Slim-line eclipse radiused body.
1. Interior Service Bracket: Utility support bracket of 11-gauge cold rolled steel that can accept attachment brackets for copper and conduit service lines.
 2. Carrier Body End Covers: Include a set of two end covers to enclose exposed ends of carrier body.
 3. Carrier Underside: Configurable to accommodate electrical outlets, service fixtures, data/voice outlets, localized exhaust units and task lighting.
 4. Include lamp assembly, exhaust panels for localized exhaust and junction boxes and ports for electrical, data, voice outlets and extractor units.
 5. Lamp Assemblies: T5HQ lamp, prismatic lens and replaceable ballasts.
 6. Lamp assemblies can be relamped by bottom removable lens cover. Accessibility from the body interior is not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of laboratory casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINETS

- A. Comply with installation requirements in SEFA 2.3. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:
 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
 2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet.
 3. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
 4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
- B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition framing, wood blocking, or metal reinforcements in partitions and to base cabinets.

- C. Base Cabinets: Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.
 - 1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.
- D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches o.c.
- E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.
- F. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF COUNTERTOPS

- A. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.
- B. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.
 - 1. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.
- C. Fastening:
 - 1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
 - 2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.
 - 3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
- D. Provide required holes and cutouts for service fittings.
- E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.
- F. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
- G. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.4 INSTALLATION OF SINKS

- A. Comply with installation requirements in SEFA 2.3.
- B. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

- C. Drop-in Installation of Epoxy Cup Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

3.5 INSTALLATION OF LABORATORY ACCESSORIES

- A. Install accessories according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions.
- B. Securely fasten adjustable shelving supports, stainless-steel shelves, and pegboards to partition framing, wood blocking, or reinforcements in partitions.
- C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.
- D. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.6 INSTALLATION OF SERVICE FITTINGS

- A. Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.
- B. Install fittings according to Shop Drawings, installation requirements in SEFA 2.3, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.7 CLEANING AND PROTECTING

- A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches o.c.

3.8 SERVICE-FITTING SCHEDULE

CW	WATER	COLD WATER FAUCET: DECK MOUNTED, GOOSENECK WITH SERRATED NOZZLE, VACUUM BREAKER, AND WRIST BLADES - #16301.729
W-1	WATER	GENERAL MIXING FAUCET, DECK MOUNTED, GOOSENECK WITH SERRATED NOZZLE, VACUUM BREAKER, AND WRIST BLADES - #16287.729
DI	WATER	DI WATER FAUCET, DECK MOUNTED - ##16402.729
PWS	WATER	PROCESS COLD WATER SUPPLY
PWR	WATER	PROCESS COLD WATER RETURN
EW	WATER	EYEWASH, DECK MOUNTED AUTOFLOW SWING DOWN AND TEMPERATURE MIXING VALVE
G	GAS	FUME HOOD CONTROL - #16511.949, 16516.009
G-3	GAS	WALL MOUNTED, SINGLE SERRATED OUTLET - #16066.909

V	VAC.	FUME HOOD CONTROL - #16516.009
V-1	VAC.	TURRET BASE, SINGLE SERRATED OUTLET - #16022.929
V-3	VAC.	WALL MOUNTED, SINGLE SERRATED OUTLET
V-4	VAC	WALL/PANEL MOUNTED OUTLET FOR BIOSAFETY CABINET CONNECTION - #16065929-NPTOUT
V-5	VAC.	QUICK DISCONNECT OUTLET FOR OVERHEAD SERVICE CARRIER - #0710351, 0707200
A	AIR	FUME HOOD CONTROL - #16511.009, 16516.009
A-1	AIR	TURRET BASE, SINGLE SERRATED OUTLET - #16022.009
A-3	AIR	WALL MOUNTED, SINGLE SERRATED OUTLET - #16065.009
A-4	AIR	WALL/PANEL MOUNTED OUTLET FOR BIOSAFETY CABINET CONNECTION - #16025.009
A-5	AIR.	QUICK DISCONNECT OUTLET FOR OVERHEAD SERVICE CARRIER
E	ELEC.	DUPLEX OUTLET, GFI, ON FUME HOOD.
E-1	ELEC.	COUNTERTOP MOUNTED PEDESTAL, (1) DUPLEX ELECTRICAL OUTLET - #06850.009
E-2	ELEC.	COUNTERTOP MOUNTED PEDESTAL, (2) DUPLEX ELECTRICAL OUTLET - #06850.009
E-5	ELEC.	DUPLEX ELECTRICAL OUTLET FOR OVERHEAD SERVICE CARRIER
E-6	ELEC.	DUPLEX ELECTRICAL OUTLET FOR TABLE APRON
D-1	DATA	COUNTERTOP MOUNTED PEDESTAL (2) DATA OUTLET
D-5	DATA	DATA OUTLET FOR OVERHEAD SERVICE CARRIER
D-6	DATA	DATA OUTLET FOR TABLE APRON
N	NITROGEN	FUME HOOD CONTROL
PTD	PAPER	PAPER TOWEL DISPENSER; BOBRICK MODEL # B-2621

END OF SECTION 123553

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes plastic-laminate countertops (included in term "millwork").

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including high-pressure decorative laminate adhesive for bonding plastic laminate and fire-retardant-treated materials.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 4. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
 - 5. Product Data: For installation adhesives, indicating VOC content.
 - 6. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
- C. 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 cutouts and holes for plumbing fixtures and other items installed in plastic-laminate countertops.
 - 2. Apply AWI Quality Certification Program label to Shop Drawings.
- D. Samples for Verification:
 - 1. Plastic laminates, 12 by 12 inches, for each type, color, pattern, and surface finish and specified edge material applied to one edge.
 - 2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish and specified edge material applied to one edge.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 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. Shop is a certified participant in AWI's Quality Certification Program.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- C. Field Measurements: Where countertops 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.
- D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
 - 1. Provide labels and certificates from AWI certification program indicating that countertops comply with requirements of grades specified.
 - 2. 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: Custom .
- C. Regional Materials: Wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- D. Certified Wood: Wood products shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- E. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS .
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in Finish Schedule or Finish Legend on Drawings.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by manufacturer's designations.
 - 2. Match Architect's sample.
 - 3. As selected by Architect from manufacturer's full range in the following categories:
 - a. Solid colors, matte finish.

- b. Wood grains, matte finish.
 - c. Patterns, matte finish.
- 4. Grain Direction: Parallel to cabinet fronts.
- G. Edge Treatment: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
- H. Core Material: Exterior-grade plywood.
- I. Core Material at Sinks: exterior-grade plywood.
- J. Core Thickness: As indicated on Drawings.
 - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.
- K. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.2 WOOD MATERIALS

- A. 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. Composite Wood Products: Products shall be made without urea formaldehyde.
 - 2. Softwood Plywood: DOC PS 1.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying 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.
 - 1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use 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 E 84, 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 special 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 treated woodwork.

2.4 ACCESSORIES

- A. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 1. Product: Subject to compliance with requirements, provide "SG Series" by Doug Mockett & Company, Inc.

2.5 MISCELLANEOUS MATERIALS

- A. Adhesives: Do not use adhesives that contain urea formaldehyde.
- B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
- C. Installation Adhesive:
 1. Adhesives shall have a VOC content of 70 g/L or less.

2.6 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Complete fabrication, including assembly, 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. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 2. 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 appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. 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 countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.

- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops 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.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c..
 - 3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123623.13

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SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.6 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in Finish Schedule or Finish Legend on Drawings.
 - 2. Type: Provide Standard type unless Special Purpose type is indicated.
 - 3. Colors and Patterns: As selected by Architect from manufacturer's full range.
- B. Particleboard: ANSI A208.1, Grade M-2.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom .
- B. Configuration:
 - 1. Backsplash: Straight, slightly eased at corner.
 - 2. End Splash: Matching backsplash.
- C. Countertops: 1/4-inch- thick, solid surface material laminated to 3/4-inch- thick particleboard with exposed edges built up with 3/4-inch- thick, solid surface material .
- D. Backsplashes: 1/2-inch- thick, solid surface material.
- E. Fabricate tops 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.
- F. Joints: Fabricate countertops without joints.
- G. Cutouts and Holes:
 - 1. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- C. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- D. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

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1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- E. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

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SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Quartz agglomerate backsplashes.
3. Quartz agglomerate end splashes.
4. Quartz agglomerate apron fronts.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Product Data: For adhesives, indicating VOC content.
3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

D. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.
2. One full-size quartz agglomerate countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

1.6 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

- A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.
 - 1. Colors and Patterns: As selected by Architect from manufacturer's full range.
- B. Composite Wood Products: Products shall be made without urea formaldehyde.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom .
- B. Configuration:
 - 1. Front: Straight, slightly eased at top.
 - 2. Backsplash: Straight, slightly eased at corner.
 - 3. End Splash: Matching backsplash.
- C. Countertops: 1/4-inch- thick, quartz agglomerate laminated to 3/4-inch- thick plywood with exposed edges built up with 3/4-inch- thick, quartz agglomerate .
- D. Backsplashes: 1/2-inch- thick, quartz agglomerate.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.
- F. Joints: Fabricate countertops in sections for joining in field.
 - 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
 - 2. Joint Type: Bonded, 1/32 inch or less in width.
- G. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - 2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by quartz agglomerate manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.

- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.19

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SECTION 126100 - FIXED AUDIENCE SEATING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fixed audience seating with the following:

1. Beam mounting.
2. Upholstered chairs.

1.2 DEFINITIONS

- A. Shell: An exposed, supporting seat bottom or back made of materials other than steel.

1.3 COORDINATION

- A. Coordinate layout and installation of electrical wiring and devices with seating layout to ensure that floor junction boxes for electrical devices are accurately located to allow connection without exposed conduit.

1.4 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of components, and finishes for fixed audience seating.
2. Include electrical characteristics of electrical components, devices, and accessories.

- B. LEED Submittals:

1. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that product contains no urea formaldehyde.

- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Seating Layout: Show seating layout, aisle widths, aisle-end alignment or stepping, row-lettering and chair-numbering scheme, chair widths, and chair spacing in each row.
2. Accessories: Show locations and features of accessories, including left- and right-hand tablet arms, electrical devices , and accessibility provisions.
3. Wiring Diagrams: For power, signal, and control wiring.

- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Baked-on Coating Finishes: Manufacturer's standard-size unit, not less than 3 inches square.
2. Wood and Plywood Materials and Finishes: Manufacturer's standard-size unit, not less than 3 inches square.
3. Upholstery Fabric: Full width by 36-inch- long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of fabric.
4. Exposed Fasteners: Full-size units of each type.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fixed audience seating to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

- a. Maintenance of self-rising seat mechanisms, folding armrests, and other operating components.
- b. Adjustment of self-rising seat mechanisms to align seats.
- c. Maintenance of electrical components, devices, and accessories.
- d. Methods for maintaining upholstery fabric.
- e. Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from the same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Chair Seats and Backs: 5 percent of quantity installed for each type and size of chair seat and back.
 - 2. Upholstered, Slip-on Cushions: 5 percent of quantity installed for each type and size of cushion.
 - 3. Tablet Arms: 5 percent of quantity installed for each type and size of tablet arm; left- and right-hand mounted.
 - 4. Armrests: 5 percent of quantity installed for each type of armrest.
 - 5. Power Receptacles: 5 percent of quantity installed.
 - 6. Chair Seat Hinges: 5 percent of quantity installed.
 - 7. Aisle-Lighting Fixture Bulbs: 5 percent of quantity installed.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of fixed audience seating that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including standards, beams, and pedestals.
 - b. Faulty operation of self-rising seat mechanism.
 - c. Faulty operation of electrical components.
 - d. Wear and deterioration of fabric and stitching beyond normal use.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Periods: As follows, from date of Substantial Completion.
 - a. Structural: Five years.
 - b. Operating Mechanisms: Three years.
 - c. Plastic, Wood, and Paint Components: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain each type of seating required, including accessories and mounting components, from single source from single manufacturer.
 - 1. Upholstery Fabric: Obtain fabric of a single dye lot for each color and pattern of fabric required.
- 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.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics of Upholstered Chairs:

1. Fabric: Class 1 according to DOC CS 191-1953 or 16 CFR 1610, tested according to California Technical Bulletin 117.
 2. Padding: Comply with California Technical Bulletin 117.
 3. Full-Scale Fire Test: Comply with California Technical Bulletin 133.
- B. Strength and Durability Performance: Chairs and components shall pass testing according to BIFMA X5.4.

2.3 FIXED AUDIENCE SEATING

- A. Fixed Audience Seating: Assembly-space seating in permanent arrangement as shown on Drawings.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Sedia Systems C100
- B. Chair Mounting Beam: Steel horizontal beam mounted on floor-attached steel support pedestals spaced at intervals of 2 to 2-1/2 chair widths. Chair attachments equipped with 180-degree swivel capability, returning to forward position when unoccupied.
- C. Side Panels: Fabric
- D. Fabric Upholstered Chairs:
1. Back:
 - a. Padding Thickness: manufacturer's standard.
 - b. Outer Back Surface micro-perforated back guard, with concealed fasteners.
 - c. Top Corners: Square.
 2. Seat: Two part, top and bottom construction and as follows:
 - a. Top Padding Thickness: Minimum 1-1/2 inches at front and rear edges.
 - b. Seat Bottom: Fabric upholstered.
- E. Chair Width: Vary chair widths to optimize sightlines and row lengths, with minimum chair width of 22 inches from center to center of armrests.
- F. Back Height: 35 inches high.
- G. Chair Seat Hinges: Self-lubricating, with noiseless self-rising seat mechanism passing ASTM F 851, positive internal stops cushioned with rubber or neoprene, and requiring no maintenance.
1. Self-Rising Seat Mechanism: Spring actuated, full fold.
- H. Armrests: Solid hardwood with rounded edges and concealed mounting.
- I. Row-Letter and Chair-Number Plates: Manufacturer's standard. Hardwood Lumber and Veneer
- J. Faces: White oak selected to be free of visible defects.
1. Stain and Finish: As selected by Architect from manufacturer's full range.
- K. Fabric: Designtex Delaine 3249-803, Charcoal.
- L. Upholstery Padding: Flexible, cellular, molded or slab polyurethane foam.

2.4 FABRICATION

- A. Floor Attachments: Fabricate to conform to floor slope so that standards and pedestals are plumb and chairs are maintained at same angular relationship to vertical throughout Project.
- B. Upholstery: Fabricate fabric-covered cushions with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.

- C. Upholstered Chairs: Fabricate as follows:
 - 1. Two-Part Upholstered Back: Padded cushion glued to a curved steel, plywood, or molded-plastic inner panel and covered with easily replaceable fabric; with curved outer back shell that fully encloses upholstery edges.
 - 2. Two-Part, Steel-Pan Seats: Upper part, an upholstered cushion with molded padding over no fewer than five serpentine springs attached to reinforced steel frame, with weight-distributing and abrasion-resistant sheeting separating padding from springs, and removable for reupholstering without removing steel pan from chair. Lower part, a steel pan, reinforced at stress points and completely enclosing hinges and self-rising mechanism.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine floors, risers, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Verify that electrical connections are properly located.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install seating in locations indicated and fasten securely to substrates according to manufacturer's written installation instructions.
 - 1. Install fixed audience seating with each chair capable of complying with performance requirements without failure or other conditions that might impair the chair's usefulness.
 - 2. Install standards and pedestals plumb.
 - 3. Install seating so moving components operate smoothly and quietly.
- B. Install seating with end standards aligned or stepped as indicated from first to last row and with backs and seats varied in width and spacing to optimize sightlines.
- C. Install riser-mounted standards and attachments to maintain uniform chair heights above floor.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Inspect components, assemblies, and equipment, including connections, to verify proper, complete, and sturdy installation according to manufacturer's written instructions and product specifications.
 - 2. Verify that seats return to correct and uniform at-rest position.
- B. Fixed audience seating will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust chair backs so that they are at proper angles and aligned with each other in uniform rows.
- B. Adjust hardware and moving parts to function smoothly so they operate easily. Lubricate bearings and sliding parts as recommended in writing by manufacturer.
- C. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.
- D. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

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- E. Replace damaged and malfunctioning components that cannot be acceptably repaired.
- F. Replace upholstery fabric damaged during installation or work of other trades.

END OF SECTION 126100

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SECTION 129300 - SITE FURNISHINGS

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. Seating.
 - 2. Bicycle racks.
 - 3. Trash Receptacles.
 - 4. Recycling Receptacles.

PART 2 - PRODUCTS

2.1 BENCHES

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. As indicated on drawings

2.2 BICYCLE RACKS

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. As indicated on drawings

2.3 TRASH RECEPTACLE

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. As indicated on drawings.

2.4 RECYCLING RECEPTACLE

- A. Products: Subject to compliance with requirements, provide the following:

2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
 - 1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211 .
 - 2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221 .
 - 3. Structural Pipe and Tube: ASTM B 429/B 429M.

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4. Castings:ASTM B 26/B 26M.
- B. Steel and Iron:Free of surface blemishes and complying with the following:
1. Plates, Shapes, and Bars:ASTM A 36/A 36M.
 2. Steel Pipe:Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
 3. Tubing:Cold-formed steel tubing complying with ASTM A 500/A 500M.
 4. Mechanical Tubing:Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
 5. Sheet:Commercial steel sheet complying with ASTM A 1011/A 1011M.
 6. Perforated Metal:From steel sheet not less than 0.075-inch nominal thickness; manufacturer's standard perforation pattern.
 7. Expanded Metal:Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
 8. Malleable-Iron Castings:ASTM A 47/A 47M, grade as recommended by fabricator for type of use intended.
 9. Gray-Iron Castings:ASTM A 48/A 48M, Class 200.
- C. Stainless Steel:Free of surface blemishes and complying with the following:
1. Sheet, Strip, Plate, and Flat Bars:ASTM A 666.
 2. Pipe:Schedule 40 steel pipe complying with ASTM A 312/A 312M.
 3. Tubing:ASTM A 554.
- D. Wood:Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
1. Wood Species: Manufacturer's standard.
 2. Certified Wood:Fabricate site furnishings with components produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
 3. Finish:Manufacturer's standard,, transparent wood preservative treatment and sealer,.
- E. Fiberglass:Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.
- F. Plastic:Color impregnated, color and UV-light stabilized, and mold resistant.
1. Polyethylene:Fabricated from virgin plastic HDPE resin.
- G. Anchors, Fasteners, Fittings, and Hardware: Stainless steel; commercial quality, tamperproof, vandal and theft resistant.
1. Angle Anchors:For inconspicuously bolting legs of site furnishings to on-grade substrate; one per leg.
- H. Galvanizing:Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:

1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.6 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment: Pressure-treat wood according to AWPA U1 and the following:
 1. Use preservative chemicals acceptable to authorities having jurisdiction and containing no arsenic or chromium. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 2. Kiln-dry lumber and plywood after treatment to a maximum moisture content, respectively, of 19 and 15 percent. Do not use materials that are warped or do not comply with requirements for untreated materials.

2.7 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.
- E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- F. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.8 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Baked-Enamel, Powder-Coat Finish:Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel, Powder-Coat Finish:Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- B. PVC Finish:Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.11 IRON FINISHES

- A. Baked-Enamel, Powder-Coat Finish:Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.12 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 directional finishes with long dimension of each piece.
 - 2. Directional Satin Finish:No 4.
 - 3. Dull Satin Finish:No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

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- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION 129300

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SECTION 130383 CONTROLLED TEMPERATURE ROOMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Fully installed, prefabricated sectional walk-in controlled temperature rooms, complete with the following:
 - 1. Factory-tested self-contained mechanical conditioning system and controls,
 - 2. External structural support of ceiling panels (if necessary),
 - 3. Lighting,
 - 4. Refrigerant piping between local/remote compressor and condenser.
 - 5. Electrical components, and
 - 6. Interconnection to building mechanical, plumbing, and electrical as indicated/required. MEP contractors to confirm location based upon available ceiling space above cold room.
- B. Cold rooms: 4 degree C.

1.2 RELATED WORK

- A. Section 123554 - Metal Lab Casework for steel sink base cabinetry
- B. DIVISION 23 – Open drain lines within (5) feet of the room. Rough-ins for plumbing, floor sinks, water piping, drains, fire sprinkler piping, equipment cooling water loops, and rough-ins for mechanical systems, as applicable. Laboratory gases shall be provided for under this section.
- C. DIVISION 26 – Electrical services to room control panel and condensing unit contactors. A fused service disconnect switch must be provided as part of the condensing unit service. Rough-ins for electrical, smoke detectors, conduit, etc. All penetrations through the environmental structure required by this Section will be provided for by this Section, including vapor seals. Coordinate with environmental room manufacturer.

1.3 REFERENCE STANDARDS

- A. In addition to complying with current edition of pertinent codes and regulations, comply with the following:
 - 1. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).
 - 2. Air Conditioning and Refrigeration Institute (ARI).
 - 3. American Society for Testing and Materials (ASTM).
 - 4. National Electrical Manufacturers Association (NEMA).
 - 5. National Sanitation Foundation's "Standard No. 7, Food Service Refrigerators, and Storage Freezers and Appurtenances" (NSF).
 - 6. Sealed Insulating Glass Manufacturers Association.
- B. Provide Underwriters Laboratories, Inc. (UL) approval of components, including labeling of wall panels.

1.4 SUBMITTALS

- A. Shop Drawings and Materials List: Prior to fabrication – 1) shop drawings and complete materials list showing dimensions, locations, finishes, details of construction, control panel layout, and utility service requirements; 2) electrical schematic with sizes and locations of electrical conduit and junction boxes; 3) refrigerant schematic showing refrigerant lines and locations of systems components; 4) re-state design and performance criteria; 5) sample testing and certifications reports.

- B. Equipment Anchorage: Detailed drawings and calculations of seismic anchorage systems, stamped and signed by a State registered structural engineer, as required to meet Life Safety Code Seismic Group III requirements.
- C. Samples: Two 12 inch x 12 inch samples of proposed wall and ceiling panel assembly (floor when provided), including joint method. Include panel finish, coved base, and gasket seal for wall to floor.
- D. Certifications: At completion of WORK stating that equipment has been installed in accordance with the specifications, drawings, applicable codes and standards, is adjusted and ready for intended function, and conforms to uniformity and recovery tests.
- E. Operations and Maintenance Manuals: Minimum of two (2) (verify number with division 1 requirements) copies of equipment manuals that describe operating procedures, maintenance and replacement schedules, bound - including wiring diagrams, component parts list with recommended spares, and factory-authorized service agencies, including phone number for emergency repairs, closest to the project.
- F. "As-built" diagram of the refrigeration piping system: include location, manufacturer and model number of all gauges, valves, shock absorbers, etc.

1.5 QUALITY ASSURANCE

- A. Requirements may differ from manufacturer's standard product. Make modifications necessary to comply with requirements. Deviations from requirements shall be listed and impacts clearly described on bid/proposal.
- B. Design is based upon manufacturer first listed. Modifications to the design may be necessary, at no cost to the owner or architect, if other listed or non-listed items/manufacturers are accepted and utilized.
- C. Document that manufacturer has established organization and production facilities specializing in the type of equipment specified, the ability to produce the specified equipment, and a proven capacity to complete an installation of this size and type within the required time limits. The manufacturer shall also have engineering, production, and service departments experienced in the design, fabrication, installation, and servicing of equipment specified herein.
- D. Additional
 - 1. UL listed
 - 2. NSF certification

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle products in a manner to avoid damage. In the event of damage, immediately make repairs and replacements necessary, at no additional cost to the Owner. Provide temporary skids under items weighing more than 150 pounds.
- B. Protect the installed WORK and materials of other trades from installation of this work.

1.7 PROJECT CONDITIONS

- A. Review surfaces and conditions under which controlled temperature room is to be installed. Available space dimensions indicated on the drawings shall be verified prior to fabrication for required clearances. Check means of access for installation. Report to ARCHITECT in writing items that may be detrimental to WORK or room operation.
- B. Coordinate sequencing with related WORK to insure proper location of required mechanical and electrical services; furnish information for mechanical and electrical interconnections.

1.8 WARRANTY

- A. The manufacturer shall warrant that equipment furnished under this section be free of defective materials, design, and workmanship. The manufacturer shall further guarantee that equipment and material conforms to this Specification and agrees to make such changes, adjustments, or replacements as necessary to meet the Specifications at no cost to the Owner. This warranty shall be in addition to and not a limitation of other rights the Owner may have under the CONTRACT Documents.
- B. This warranty shall be valid for a period of one (1) year from the date of substantial completion. Refrigeration compressors shall be under warranty for a period of five (5) years, and insulated room panels for a period of ten (10) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers:
 - 1. BioCold Environmental, Inc.
160 Old State Road
Ellisville, MO 63021
636 349-0300
 - 2. Harris Environmental Systems
11 Connector Road
Andover, MA 01810
978 470-8600
 - 3. Luwa Environmental Specialties
Life Scientific Inc.
3720 Hampton Ave. Suite 204
St. Louis, MO 63109
314 752-9400 ext. 101
 - 4. Nor-Lake Incorporated
P.O. Box 248
Hudson, WI 54016
800-477-5253

2.2 MANUFACTURED UNITS

- A. Room size shall be as shown on drawings. Sizes indicated are nominal, manufacturer to confirm with ARCHITECT minor size variation.
- B. Inside clear height to be a minimum of 8 feet 0 inches.
- C. Room shall be of modular construction incorporating wall, ceiling, and floor "sandwich panels" consisting of interior and exterior metal skins with a solid core of insulation. Construction shall allow disassembly for possible relocation or expansion at a later date. Each room, unless otherwise specified, shall be complete with controls, refrigeration and air conditioning systems, heating, piping, lighting systems, and necessary mechanical and electrical components, including electrical outlets and wire ways (where noted).
- D. Modular Panel Construction:
 - 1. Overall wall and ceiling panel thickness shall be 4" nominal. Floor panel thickness shall be 2" nominal. Panels shall contain NO wood or bridging metal. Closure panel finish and texture shall match adjacent panels, unless otherwise noted.

2. Panel joints shall be secured with integral mechanical fasteners, such as cam locks. Joints shall be continuous caulked and sealed by NSF approved gaskets or silicone sealants to provide vapor-proof and airtight joints. Flush-mounted plastic or stainless steel caps shall close wrench holes. Furnish one wrench for each room.
 - a. Foam-In-Place Isocyanurate:
Panel insulation shall be foamed-in-place isocyanurate insulation providing a "K" factor of 0.118 Btu/hour/square foot/degree Fahrenheit/inch of thickness. Insulation shall bond the panel and shall have a minimum compressive strength of 28 pounds per square inch. Sections shall match without distortion and shall be aligned by tongue and groove joint, fastened by cam lock devices, maximum 46" apart. All foam shall be Class I.
 3. Panels shall have a flame spread of not more than 25 and smoke generation of not more than 450 when tested in accordance with ASTM E84.
 4. Wall and Ceiling Panels:
 - a. Interior surface shall consist of 26 gauge smooth galvanized steel with a white polyester enamel finish.
 - b. Exposed exterior surface shall consist of 26 gauge smooth galvanized steel with a white polyester enamel finish
 5. Floor panels shall be 14 gauge ~~galvanized~~ **rigidized stainless** steel with a minimum 600 psf distributed stationary load capacity. Floor panels shall have an ADA compliant interior ramp at each walk-in door as noted on floor plans. Slope shall not exceed 1: 20 with anti-skid safety tape. Floor covering specified herein.
 6. Ceiling Supports (if required): External to room with no visible connections from interior, in accordance with manufacturer's recommendations with approval of the Architect.
- E. Manual Swinging Door and Lockable Door:
1. Door shall be in fitting, self-closing, fully gasketed, and flush mounted with cylinder lock door latch allowing interior safety release. Door latch shall be heavy duty, chrome plated with a forged handle. The force required to open and close the door shall not exceed 5 pounds. Each door panel shall have vertical steel channels on each side of door to prevent warping or racking. Provide reinforcing at latch and hinge stress points. Hinges shall be cam-acting self-closing with steel pins and nylon bushings.
 2. Minimum clear opening of 36 inches by 80 inches.
 3. Perimeter and Frame: Galvanized steel with double gasketing on three sides and wiper gasket on bottom.
 4. Doors shall incorporate a triple panel sealed safety glazed observational window, nominal 14 inches by 23 inches with anti-sweat heaters.
 5. Door insulation, and exposed surfaces shall be same material as wall panels.
 6. At Cold Rooms(4 degree C), provide an anti-sweat heater on door, to prevent condensation and frost formation. The heater shall be positioned beneath the metal edge of the doorframe on all four sides, easily accessible for replacement and service.
 7. Cold Rooms to have glass doors with light strip around the perimeter. Number of doors to be as indicated on the drawings.

2.3 PERFORMANCE AND CONTROL REQUIREMENTS

Room #	Room Type	Temperature Range	Tolerance	Notes
02-132	Refrigerated	+04°C	± 2.0° C	

1. Temperature range shall be the temperature at the sensing bulb and shall be the total adjustment in the temperature of the room. Do not confuse with temperature distribution defined below.
 2. Temperature distribution is to be $\pm 0.5^{\circ}\text{C}$ as measured on a horizontal plane 40" above the floor and extending to within 12 inches of walls.
- B. Room shall recover to preset operating temperature within 5 minutes after door has been fully opened to 75°F ambient for a period of one (1) full minute.
- C. Allow for the following internal loads, unless otherwise noted:
1. Lighting: 2-watts per square foot minimum, intermittent.
 2. People: 2, Intermittent.
 3. Door Openings: 2 per hour lasting one minute.
 4. Equipment Load: To a maximum of 5w/sq.ft.
 5. Fan Heat: As required.
- D. Instruments and Control Systems:
1. All operating controls, instrumentation, functional switches and major electrical components shall be located in a single, surface-mounted control console mounted at operator eye level at the latch side of the entrance door to each room unless otherwise shown on the drawings. Control console shall be ADA compliant and exterior depth shall not exceed 4 inches. The control panel shall be hinged for easy opening by authorized service personnel.
 2. All room equipment except condensing unit, unless otherwise indicated on drawings, shall be circuited through the control console and wired by CER installer, with a single-point connection to the control console supplied by Division 26.
 3. Control panel assembly shall contain only commercially available components available from third-party suppliers. CER manufacturer's proprietary printed circuit boards are not acceptable.
 4. Overcurrent protection shall be provided within the control console. All branch circuits shall be equipped with circuit breakers. Fuses are not permitted.
 5. Control panel assembly shall be tested by a UL listed shop in accordance with NFPA 70 and UL 508A, and shall bear a UL 508A label.
- E. Color Touchscreen Interface
1. User interface shall consist of a LCD color touchscreen display at least 7 inches in diagonal with minimum resolution of 640 x 480 pixels.
 2. Color touchscreen shall provide intuitive operation and sufficient on-screen instructions such that reference manuals are not required for day-to-day operation.
 3. Color touchscreen shall provide multi-level password-protected access to monitor and adjust all chamber operating parameters, including but not limited to the following functions:
 - a. Temperature setpoint
 - b. Real-time temperature display in 0.1°C or 0.1°F increments
 - c. Humidity setpoint (if applicable)
 - d. Real-time humidity display in 0.1% RH increments
 - e. User-selectable temperature display in $^{\circ}\text{C}$ or $^{\circ}\text{F}$.
 - f. High & low temperature and humidity alarm setpoints
 - g. Alarm time delay period
 - h. Alarm silence with adjustable callback timer
 - i. Automatic, programmable defrost system with automatic bypass when operating above 3°C , adjustable.

- j. Manual defrost and manual defrost termination capabilities for testing and maintenance.
- k. Real-time system clock.
- l. Real-time graphical trend data with minimum of 31 day viewable history
- m. Print and/or download trend data for minimum of 360 days in PDF or CSV format
- n. Parameter change log.
- o. Alarm history log
- p. Remote access capability via Ethernet, RS-485 Modbus or similar, non-proprietary communications protocol.

2.4 ENVIRONMENTAL CONDITIONING SYSTEM:

- A. Enclose air handling evaporator unit, consisting of blowers, coils, heaters, drain pans, etc. in a modular enclosure with appropriate guards and access panels suspended from the ceiling. Enclosure finish to match color of interior of ceiling panels.
- B. Refrigeration System:
 - 1. System to be sized by the manufacturer. ~~Install the system to allow the motor compressor to operate continuously in ambient temperature of 95°F with a proportionally controlled refrigeration cycle pump down to maintain specified temperature.~~ **System shall be designed with proportional hot gas bypass operation to allow the motor compressor to operate continuously in ambient temperature of 95 d F and not pump down to maintain specified temperature.** System shall incorporate automatic hot gas defrost to prevent condensate pan or drain line freezing for rooms whose operating temperature extends below 10°C. Provide timed and temperature terminated electric defrost for use when room is designed to operate below -4°C. A nominal temperature rise will be allowed during the defrost cycle. Provide a fully redundant system for each chamber. Each chamber must cycle between each system so as to reduce wear of the components
 - 2. Compressor/Condensing Unit: Adequate capacity to achieve and maintain the room operating temperature and/or humidity requirements, sized to handle the additional heat loads of equipment. Unit shall be pre-wired with a single-point connection to building electrical. Unit shall be complete, including high/low pressure control, receiver, sight glass, liquid line dryer, expansion valves and necessary equipment to achieve specified performance. Include starters, control transformer, and pre-wired terminal block for room control interlocks.
 - 3. Provide a sound shell for the compressor that attenuates sound by 10-12dB(A).
 - 4. Condenser shall be AIR-cooled. Mount the compressor/condensing unit assemble as noted below on a vibration and seismic control base. Units will require stacking frame for up to three units. Penetrations and curbs ~~by other portions of the Work to be~~ **provided by Controlled Temperature Room installer.** Provide required connecting piping to room. Refer to drawings for location.

Room Type	Proposed condenser location
Freezer	remotely within 100'-0"
Refrigerated	remotely within 100'-0"

- 5. Refrigerant shall be CFC free R404A or equivalent.
- 6. Refrigerant Piping (unless otherwise noted) shall be seamless copper tubing, Type L, cold drawn, hard temper ASTM B 88 with wrought copper solder sweat type fittings, ANSI B 16-22 or brass castings ANSI B 16-18. Suction and hot gas piping shall pitch toward condensing unit. Insulate with fire retardant materials.

7. Maximum sound level in room of 65 dba with fan operational, exclusive of occupancy generated noise. Reduce fan noise by oversizing fan or fans; reduce fan speed as required to furnish satisfactory air circulation; air velocity across coils not to exceed 500 fpm
 8. Provide slimline evaporator units to maximize headroom.
- C. When electrical heaters are used as part of the evaporator assembly to maintain room conditions, they are to be wired through multiple circuits with automatic control heat input with manual override adjustment. Utilize nichrome wire heaters operating in black heat range with low watt density distribution in air duct. Provide screening to prevent contact with electrical resistant elements.
- D. Dehumidification shall be by mechanical refrigeration and reheat with drainage to building drain.

2.5 ELECTRICAL

- A. The following electrical power is provided by other portions of the WORK. Contractor shall notify Owner in writing if equipment requirements vary from that provided. Contractor shall incur all costs and design fees necessary to provide differing power requirements.
1. For remote compressor, 208v 3 phase.
 2. For lights/recorder/controls/evaporator: 120/208v, 20 amps, 1 phase.
 3. For receptacles, 120v circuits 20 amps.
- B. Electrical components shall be UL-listed. Conductors shall conform to Article 310 of the NEC; motors, motor circuits and controllers shall conform to Article 430 of the NEC.
- C. Provide weatherproof while in use, National Electrical Manufacturer's Association (NEMA) 5-20R duplex receptacles. Mount the bottom of receptacles 42 1/2" above finish floor at 4'-0" O.C. on side and back walls, unless otherwise noted.
- D. Where noted on the drawings, provide Surface-Mounted Raceways (SMR)(Wireways) and connect to J-Box.
- E. Conduit and the electrical outlet boxes shall be internal, imbedded in the foam insulation to provide a clean surface both internally and externally.
- F. Provide 208Y/120 volt, 3 phase branch circuit panelboard to serve equipment and wiring devices within the rooms and coordinate with the three phase, four wire plus ground feeder from the building's power system. Coordinate connection of a 120 volt, single phase optional standby emergency power branch circuit for operation of alarm and controls. Control panel shall have a cooling failure relay to open all branch circuits should the room temperature exceed a preset level.
- G. Rooms shall be wired by manufacturer and shall require a maximum of two power connections to the room: one normal power three phase feeder for the internal panelboard and one optional standby single phase branch circuit for alarms and controls. A third three phase power connection shall be provided from the building's power distribution system to serve the remote compressors. Power wiring, control wiring and conduit between the control cabinet and the remote condensing unit shall be provided by the manufacturer and meet requirements of Division 26.
No internal exposed conduit allowed.
- H. Individual fused switch type disconnect for condensing unit shall be as specified in DIVISION 26.
- I. Lighting systems shall utilize rapid start cool white fluorescent lamps. Lamps and electronic ballasts shall be enclosed in vapor-proof gasketed UL-listed fixtures rated to operate at temperatures as low as -20°C (as high as 40°C in rooms operating above ambient temperature). Surface mount light fixtures on the ceiling and provide a sufficient quantity to maintain a light

intensity of 70 foot candles measured 36 inches above the room floor at a temperature of 20°C. Remote ballasts are acceptable if temperature range requires. Room shall be equipped with one (1), 40W, vapor proof, safety light fixture located above each door. Safety lighting shall be powered only during alarm conditions.

2.6 ACCESSORIES

- A. Free standing stainless Steel Wire shelving: Owner furnished owner installed
- B. ~~Stainless Steel~~ **Provide backing for** worksurfaces, brackets and shelves.
- C. Provide backing and conduit for smoke detector by other portions of the WORK that will have contacts for connection to remote building monitoring automation system. Provide a 3/4" sleeve in roof of controlled temperature room for fire sprinkler piping installation near the entry door to the room. Fire sprinkler piping by other portions of the work.

2.7 OTHER PRODUCTS

- A. Other products necessary for complete installation and operation shall be subject to the acceptance of the Owner's representative.
- B. Provide each equipment item with the manufacturer's standard features and accessories as well as any other accessories, options or special configurations shown on the drawings or elsewhere in the specifications. For recessed or freestanding equipment, provide trim panels matching equipment material and finish to close opening between equipment and adjacent walls, floors and ceilings, and where indicated on Drawings.
- C. Provide a list of manufacturer's options for utility conservation with submission of bid. Include data to support return of investment on each piece of equipment based on reduced utility consumption.
- D. Manufacturer shall provide a break down on pricing if some or any of their components, materials or options deviates from what is listed in this specification, so it can be considered by the owner in their final decision.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installing controlled temperature rooms, ensure that preparatory WORK is complete to the point where this installation may properly commence. Note that substrate conditions are per that section's tolerances.
- B. Field verify that space rough-in dimensions are as indicated.

3.2 PREPARATION

- A. Proceed with WORK when conditions will permit WORK to be installed in complete accordance with the original design, accepted submittals, and the manufacturer's printed instruction. Commencement of WORK indicates acceptance of substrate conditions.

3.3 INSTALLATION

- A. Install in accordance with referenced codes/standards, manufacturer's printed instructions, and accepted submittals for a complete operating system.
- B. Set panels plumb and level, square, in true alignment, at proper locations, planes, or elevations, in correct relationship to other work, and securely fasten together. Install floor panels, where applicable, for flush joints between panels and in a continuous bead of sealant for smooth transition to adjoining floor surfaces.

- C. Mount mechanical and electrical equipment seismically secure with vibration isolation for rotating motors. Use wire ways for exposed electrical on exposed exterior of rooms. ARCHITECT shall review placement of exposed pipes/conduits prior to installation. Horizontal refrigeration suction lines shall be pitched downward in the direction of flow. Liquid lines shall be pitched downward toward the liquid receiver. Install condensate drain line from evaporator condensate pan, through the wall panel to discharge into building drain. Blow dry conduit and junction boxes to eliminate condensation within junction boxes before start-up of refrigeration systems. Charge the system per manufacturer's written recommendations. After system has been installed and integrity of system is established, cover refrigeration suction lines with insulation and vapor barrier.
- D. Penetrations into room shall be properly sealed with silicone caulking. Provide stainless steel escutcheon plates at visible locations. For multiple penetrations at any one location, provide a neoprene gasket that provides a minimum of 1/2" around each pipe, and encompasses all the penetrations.
- E. Caulk panel joints on inside surfaces; apply sealant in accordance with sealant manufacturer's recommendations. Apply sealant around the exterior periphery of the floor panels between the lower metal facing and the floor substrate.
- F. Provide vertical and horizontal closure panels and strips to enclose opening between controlled temperature room and adjacent wall, building partitions, and/or ceiling. Finish to match controlled temperature room exterior.

3.4 FIELD QUALITY CONTROL

- A. Certification and Testing:
 - 1. Acceptance testing shall consist of sustained operation at minimum, maximum and midpoint temperature condition for a minimum period of 24 hours each, at no less than four points in room, unless otherwise noted. Uniformity shall be measured and recorded by a multi-point strip chart recorder utilizing a minimum of 12 thermocouples during a continuous 24-hour test period. Furnish recorder or strip charts (unit to be certified for accuracy within one year prior to test) to the Owner's representative. Acceptance shall be conditioned upon successful completion of the acceptance test. Owner's representative shall be notified a minimum of 72 hours in advance of test and given option to witness test.
 - 2. Provide technician to instruct designated Owner's representatives to inform them of proper room operation and maintenance.
 - 3. Provide written certification that room performance complies with specified criteria, has passed acceptance test, and meets applicable standards.
- B. Refrigerant Piping Pressure Test:
 - 1. Pressure test refrigeration piping with dry carbon dioxide or dry nitrogen to a gauge pressure of 150 psi on the low side and 200 psi on the high side.
 - 2. When pressure test is completed and system found to be tight and free of leak, blow-off pressure to atmosphere and evacuate the system using a vacuum pump. Use a Zimmerli gauge to record a vacuum pressure of 500 microns. When the system has been evacuated, break the vacuum with oil-pumped dry nitrogen. Open the pressure suction and discharge valves and reevaluate the system to 2.5mm Hg absolute and let stand for 12 hours. If no noticeable rise in pressure has taken place, system may be charged. After charging a halide torch, test shall be made of joints.
- C. Deliver operation and maintenance manuals.

3.5 ADJUSTING AND CLEANING

- A. Adjust equipment and services to operate correctly and smoothly without warp or bind. Lubricate operating parts as recommended by manufacturer.
- B. Clean and polish exposed surfaces in accordance with manufacturer's instruction.
- C. Touch up and restore any factory finishes partially damaged or defaced during delivery, relocation, and installation. Repair or remove and replace defective WORK as approved by the Owner's representative at no additional cost to the Owner.

3.6 PROTECTION

- A. Units shall be protected after installation during remainder of construction.
- B. Installer shall shut off equipment and lock doors to prevent access by unauthorized persons.

END OF SECTION 130383

SECTION 142100 - ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes electric traction passenger and service elevators.

1.2 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- B. Service Elevator: A passenger elevator that is also used to carry freight.

1.3 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Include large-scale layout of car-control station.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
 - 4. Include the following electrical and communications characteristics:
 - a. Motor HP, voltage, full-load amperage, peak amperage, power factor.
 - b. Elevator equipment room disconnect fuse type and size.
 - c. Statement indicating no regenerative power reflected back into electrical distribution system.
 - d. Emergency power mode of operation description.
 - e. List of items to be received and installed within the elevator cab.
 - f. Firefighter's jack
 - g. Public address speaker.
 - h. Fire alarm speaker.
 - i. Fire alarm smoke detector.
 - j. Emergency phone.
 - k. Traveling cable provisions for associated power, signal, and communications systems.
 - l. Description of required field connections.
- C. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and control closet layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard two-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.8 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.9 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Insert manufacturer's name; product name or designation Otis Elevator Company; Gen2 Gearless Machine-Room Less Elevator.
- B. Source Limitations: Obtain elevators from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

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- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44, state and local building codes and requirements of authorities having jurisdiction.
- B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance 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, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Passenger Elevator Description:
 - 1. Passenger Elevator Number: One (1).
 - 2. Machine Location: Hoistway; no machine room is provided.
 - 3. Machine Type: Gearless traction, with controllers remotely located on level 01.
 - 4. Rated Load: 3500 lb.
 - 5. Rated Speed: 200 fpm Insert value.
 - 6. Operation System: independent single car operation.
 - 7. Auxiliary Operations:
 - a. Battery-powered lowering.
 - b. Nuisance call cancel.
 - 8. Car Enclosures:
 - a. Inside Width: as indicated from side wall to side wall.
 - b. Inside Depth: as indicated from back wall to front wall (return panels).
 - c. Inside Height: 7 feet 9 inches to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
 - e. Car Fixtures: Satin stainless steel, No. 4 finish.
 - f. Side and Rear Wall Panels: TBD.
 - g. Reveals: TBD.
 - h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
 - i. Door Sills: Aluminum, mill finish.
 - j. Ceiling: LED downlight ceiling. 6 rectangular LED lights, white finish.
 - k. Handrails: 1/2 by 2 inches rectangular satin stainless steel, No. 4 finish, at sides and rear of car.
 - l. Floor prepared to receive terrazzo flooring.
 - 9. Hoistway Entrances:
 - a. Width: 42 inches.
 - b. Height: 84 inches.
 - c. Type: Single-speed center opening.
 - d. Frames: Satin stainless steel, No. 4 finish.
 - e. Doors: Satin stainless steel, No. 4 finish.
 - f. Sills: Aluminum, mill finish.
 - 10. Hall Fixtures: Satin stainless steel, No. 4 finish.
 - 11. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
- C. Service Elevator Description:
 - 1. Service Elevator Number: Two (2).
 - 2. Machine Location: Hoistway; no machine room is provided.

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3. Machine Type: Gearless traction, with controllers remotely located on level 01.
4. Rated Load: 4500 lb (service).
5. Freight Loading Class for Service Elevator(s): Class A.
6. Rated Speed: 200 fpm Insert value.
7. Operation System: independent single car operation.
8. Auxiliary Operations:
 - a. Standby power operation.
 - b. Nuisance call cancel.
9. Car Enclosures:
 - a. Inside Width: as indicated from side wall to side wall.
 - b. Inside Depth: as indicated from back wall to front wall (return panels).
 - c. Inside Height: 7 feet 9 inches to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
 - e. Car Fixtures: Satin stainless steel, No. 4 finish.
 - f. Side and Rear Wall Panels: TBD.
 - g. Reveals: TBD.
 - h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
 - i. Door Sills: Aluminum, mill finish.
 - j. Ceiling: LED downlight ceiling. 6 rectangular LED lights, white finish.
 - k. Handrails: 1/2 by 2 inches rectangular satin stainless steel, No. 4 finish, at sides and rear of car.
 - l. Floor prepared to receive rubber floor tile.
10. Hoistway Entrances:
 - a. Width: 48 inches.
 - b. Height: 84 inches.
 - c. Type: Two-speed side sliding.
 - d. Frames: Satin stainless steel, No. 4 finish.
 - e. Doors: Satin stainless steel, No. 4 finish.
 - f. Sills: Aluminum, mill finish.
11. Hall Fixtures: Satin stainless steel, No. 4 finish.
12. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
 - b. Provide hooks for protective pads in car designated as service and one complete set(s) of full-height protective pads.
 - c. Provide card access control.

D. Electrical Requirements and Operations

1. Voltage: 480 Volts, 3 phase
2. Minimum Power Factor: 0.8
3. Fuse Protection: Selected for application by supplier
4. Wiring: Provide wiring from control panels and relay panels to equipment and from hoistway junction box to elevator. Provide transformer for required relay panel control voltage. Install all wiring in metal wireways, galvanized steel and liquid-tight flexible raceways as specified in Division 26 Section "Raceways", except for traveling cables.
 - a. Branch Circuit and Control Wiring: TEW or THW insulation, 600 volts.
 - b. Signal and Communication Wiring: Meet system manufacturer's requirements. Provide wiring in machine room for system interconnection to hoistway junction box. Extend from hoistway junction box to cab with traveling cables.

- c. Traveling Cables: UL labeled fire and moisture resistant with outer braid and steel supporting strand. Provide cables for all systems links to cab with minimum 10 percent spares for each cable type.

2.4 TRACTION SYSTEMS

- A. Elevator Machines: Variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
 - 1. Provide nonregenerative system.
 - 2. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.
- B. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- C. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 05 Section 055000 "Metal Fabrications" for materials and fabrication.
- D. Car Frame and Platform: Bolted- or welded-steel units.
- E. Guides: Roller guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.
- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 - 1. Elevator #1; Single-Car Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to the next floor below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 - 2. Elevator #2; Single-Car Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at fire command station. Manual operation causes automatic operation to cease.
- C. Card Access Control: Provide card access control on service elevator #2. Include traveling cable as required.

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.

2.7 CAR ENCLOSURES

- A. General: Provide steel-framed car enclosures with nonremovable wall panels, with 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: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
2. Floor Finish:
 - a. Elevator #1: TER-1 (terrazzo).
 - b. Elevator #2: RBF-1 (rubber).
3. Wall Finish:
 - a. Elevator #1: Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch fire-retardant-treated particleboard with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 or less, when tested according to ASTM E 84. Wood grain laminate panels to be plastic-laminate color, plam-1, (upgrade option) Formica Finish Oak 118-58 matte finish.
 - b. Elevator #2: Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
4. Ceiling: Stainless steel drop ceiling with 6 LED.
5. Handrail: 6 inch flat stainless steel.
6. Reveals / Toekick – Stainless steel.
7. Fabricate car with recesses and cutouts for signal equipment.
8. Fabricate car door frame integrally with front wall of car.
9. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet, interior and exterior of both cabs.
10. Sills: Extruded metal, with grooved surface, 1/4 inch thick.

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. 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 sheet.
 3. Sills: Extruded metal, with grooved surface, 1/4 inch thick.

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. Fabricate lighted elements 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. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.
 2. 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. 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.
- E. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
 - 3. Provide oversized plate to include emergency egress signage, and firefighters' keyswitch where applicable. Refer to drawings for dimensions and graphics.
- F. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:
 - 1. Provide stainless steel flat faceplate to match Hall Station. Mount as indicated on the drawings.

2.10 FINISH MATERIALS

- A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- E. Stainless-Steel Bars: ASTM A 276, Type 304.
- F. Aluminum Extrusions: ASTM B 221, Alloy 6063.
- G. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. 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.

- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. 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 above finished floor.

3.3 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.
- B. Operating Test: Load each elevator to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machine during 30-minute test period. Record failure to perform as required.
- C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).
- B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.5 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 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 at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance during normal working hours.
 - 2. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 142100