PROJECT MANUAL

Renovate Interior & Exterior
Readiness Center Building

Mexico Readiness Center

Mexico, Missouri

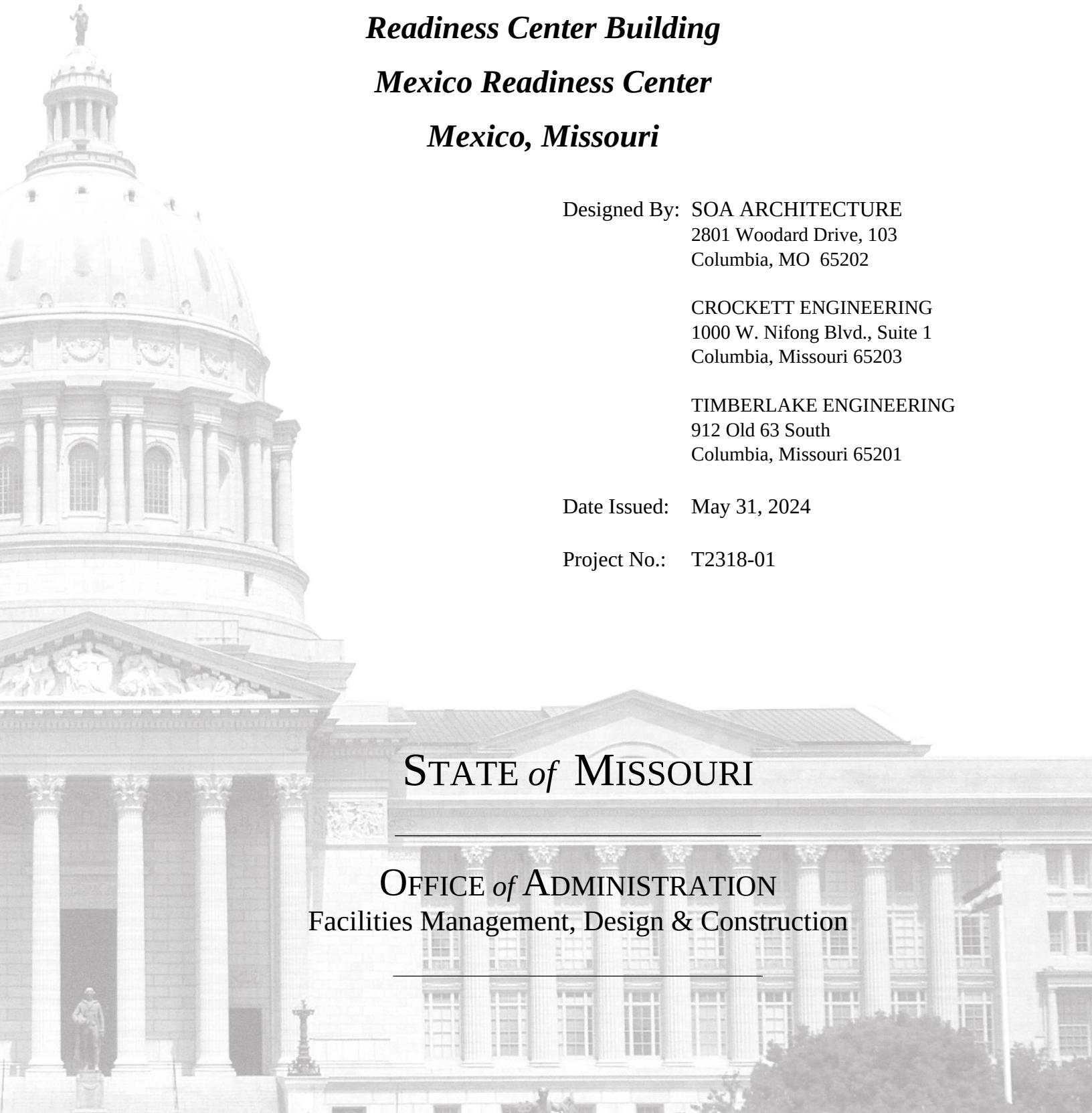
Designed By: SOA ARCHITECTURE
2801 Woodard Drive, 103
Columbia, MO 65202

CROCKETT ENGINEERING
1000 W. Nifong Blvd., Suite 1
Columbia, Missouri 65203

TIMBERLAKE ENGINEERING
912 Old 63 South
Columbia, Missouri 65201

Date Issued: May 31, 2024

Project No.: T2318-01



STATE *of* MISSOURI

OFFICE *of* ADMINISTRATION
Facilities Management, Design & Construction

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

PROJECT NUMBER: T2318-01

THE FOLLOWING DESIGN PROFESSIONALS HAVE SIGNED AND SEALED THE ORIGINAL PLANS AND SPECIFICATIONS FOR THIS PROJECT, WHICH ARE ON FILE WITH THE DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION:

SOA ARCHITECTURE

I Jennifer M Hedrick hereby specify, pursuant to RS MO 327.411, that the documents or instruments relating to be authenticated by my seal are limited to:

Drawings:

G001	COVER SHEET
G002	SHEET LIST
G003	CODE SHEET
A101	MRC BUILDING DEMOLITION PLANS
A102	MRC BUILDING CLERESTORY DEMOLITION ELEVATIONS
A103	MRC BUILDING DEMOLITION PLAN - ROOF
A201	MRC BUILDING NEW WORK FLOOR PLANS
A202	MRC BUILDING REFLECTED CEILING PLAN
A203	MRC BUILDING ROOF PLAN
A301	MRC BUILDING ELEVATIONS
A302	MRC BUILDING ELEVATIONS - EIFS REPAIR
A401	MRC BUILDING SECTIONS
A501	TYPICAL CASEWORK DETAILS & MOUNTING HEIGHTS
A502	ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS
A601	WALL SECTIONS
A701	DOOR & FRAME SCHEDULE, WINDOW SCHEDULE, DOOR DETAILS
A702	FINISH FLOOR PLAN
A703	ROOM FINISH SCHEDULE & INTERIOR FINISH KEY
A801	COLD STORAGE BUILDING DEMOLITION & NEW WORK PLANS
A802	COLD STORAGE BUILDING ELEVATIONS
A803	OLD FMS - DEMOLITION, NEW WORK & RELFECTED CEILING PLANS

Specifications:

01 1000	Summary of Work
01 2100	Allowances
01 2200	Unit Prices
01 2300	Alternates
01 2600	Contract Modification Procedures
01 3100	Coordination
01 3115	Project Management and Coordination
01 3200	Schedules
01 3300	Submittals
01 3513.28	Site Security and Health Requirements (State Fair, Veterans, MONG)
01 5000	Construction Facilities and Temporary Controls
01 7400	Cleaning
01 7900	Demonstration and Training
02 8200	Asbestos Remediation
02 8300	Paint Removal, Handling And Disposal
03 5413	Gypsum Cement Underlayment
04 4200	Concrete Unit Masonry
06 4116	Plastic-Laminate-Clad Architectural Cabinets
07 2413	Polymer-Based Exterior Insulation and Finish System (EIFS)
07 2723	Board Product Air Barriers
07 5323	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 6200	Sheet Metal Flashing and Trim
07 7100	Roof Specialties
07 7200	Roof Accessories
07 9200	Joint Sealants
08 1113	Hollow Metal Doors and Frames
08 3250	Bullet-Resistant Security Aluminum Windows, Doors and Frames
08 3113	Access Doors and Frames
08 3313	Coiling Counter Doors
08 3613	Sectional Doors
08 4313	Aluminum-Framed Storefronts
08 5113	Aluminum Windows
08 7100	Door Hardware
08 7113	Power Door Operators
08 8000	Glazing
08 8300	Mirrors
08 8853	Security Glazing
09 2216	Non-Structural Metal Framing
09 2900	Gypsum Board
09 5113	Acoustical Panel Ceilings
09 6513	Resilient Base and Accessories

Specifications (continued):

09 6519 Resilient Tile Flooring: Luxury Vinyl Tile and Rubber Tile
09 6723 Resinous Epoxy Flooring and Resinous Wall System
09 9113 Exterior Painting
09 9123 Interior Painting
102113.19 Plastic Toilet Compartments
10 2239 Folding Panel Partitions
10 2600 Wall and Door Protection
10 2613 RFP Panels
10 2800 Toilet, Bath, and Laundry Accessories
10 4113 Fire Protection Cabinets
10 5300 Prefabricated Cantilever Canopy
12 2113 Horizontal Louver Blinds
12 3661.16 Solid Surfacing Countertops
13 3419 Metal Building Systems

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

CROCKETT ENGINEERING (CIVIL)
I Timothy D. Crockett hereby specify, pursuant to RS MO 327.411, that the documents or instruments relating to be authenticated by my seal are limited to:

Drawings:

C001	CIVIL GENERAL INFORMATION
C100	DEMOLITION PLAN
C101	EROSION CONTROL PLAN
C102	GRADING PLAN
C103	UTILITY PLAN
C104	STORM SEWER PROFILES & DETAILS
C105	SITE PLAN
C500	SITE CONSTRUCTION DETAILS
C501	FENCE, STAIR & HANDRAIL DETAILS

Specifications:

31 1000	Site Clearing and Demolition
31 2000	Earth Moving
31 2500	Erosion Control
32 1313	Concrete Pavement
32 1373	Concrete Paving Joint Sealants
32 1723	Pavement Markings
32 9200	Turf and Grasses
33 4100	Storm Utility Drainage Piping

5/31/24

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

CROCKETT ENGINEERING (STRUCTURAL)

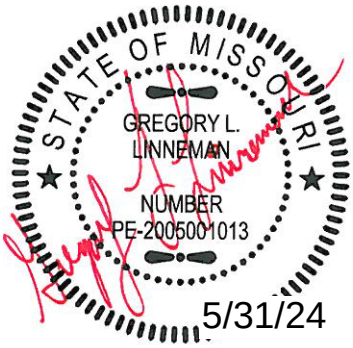
I, Greg Linneman, hereby specify, pursuant to RS MO 327.411, that the documents or instruments relating to be authenticated by my seal are limited to:

Drawings:

S001	GENERAL STRUCTURAL DATA
S101	MRC SLAB PLAN & DETAILS
S201A	MRC ROOF FRAMING PLAN & DETAILS
S201B	MRC ROOF FRAMING DETAILS
S202	COLD STORAGE BUILDING PLAN & DETAILS (ALTERNATE #2)

Specifications:

03 3000	Cast-in-Place Concrete
05 1200	Structural Steel Framing
05 4000	Cold-Formed Metal Framing
05 5000	Metal Fabrications



GREGORY L. LINNEMAN - PE
MO LICENSE - 2005001013

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

TIMBERLAKE ENGINEERING (Mechanical, Electrical, Plumbing)
I, Shane Floyd, hereby specify, pursuant to RS MO 327.411, that the documents or instruments relating to be authenticated by my seal are limited to:

Drawings:

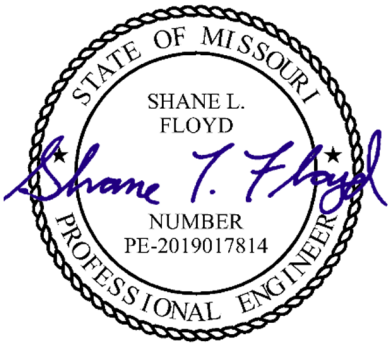
MEP101 MEP ROOF PLAN
M000 MECHANICAL NOTES, SPECIFICATIONS, AND LEGENDS
MD101 MAIN BUILDING MECHANICAL DEMO PLAN
MD201 ALTERNATE NO. 3 OUT BUILDINGS MECHANICAL DEMO PLAN
M101 MAIN BUILDING MECHANICAL PLAN
M201 ALTERNATE NO. 3 OUT BUILDINGS MECHANICAL PLAN
M301 MECHANICAL SECTIONS
M501 MECHANICAL DETAILS
M502 MECHANICAL DETAILS
M601 MECHANICAL SCHEDULES
M602 MECHANICAL SCHEDULES
M603 KITCHEN HOOD DRAWINGS
M604 KITCHEN HOOD DRAWINGS
M605 KITCHEN HOOD AND EXHAUST FAN DRAWINGS
M606 KITCHEN DOAS DRAWINGS
M607 KITCHEN DOAS DRAWINGS
M608 KITCHEN ELECTRICAL SCHEMATIC
M609 KITCHEN ELECTRICAL SCHEMATIC
M610 KITCHEN LOW VOLTAGE DRAWINGS
E000 ELECTRICAL NOTES, SPECIFICATIONS, AND LEGENDS
ED101 ELECTRICAL DEMO PLAN
ED201 ALTERNATE NO. 3 OUT BUILDINGS ELECTRICAL DEMO PLAN
EL101 MAIN BUILDING ELECTRICAL LIGHTING PLAN
EL201 ALTERNATE NO. 3 OUT BUILDINGS ELECTRICAL LIGHTING PLAN
EP101 MAIN BUILDING ELECTRICAL POWER PLAN
EP201 ALTERNATE NO. 3 OUT BUILDINGS ELECTRICAL POWER PLAN
EP202 ELECTRICAL SITE PLAN
E501 ELECTRICAL DETAILS
E601 ELECTRICAL SCHEDULES
P000 PLUMBING NOTES, SPECIFICATIONS, AND LEGENDS
PD101 MAIN BUILDING PLUMBING DEMO PLAN
PD201 ALTERNATE NO. 3 OUT BUILDINGS PLUMBING DEMO PLAN
P101 MAIN BUILDING PLUMBING PLAN
P201 ALTERNATE NO. 3 OUT BUILDINGS PLUMBING PLAN
P401 MAIN BUILDING PLUMBING PLANS ENLARGED
P501 PLUMBING DETAILS
P502 PLUMBING DETAILS
P601 PLUMBING SCHEDULES AND RISER

Specifications:

22 0500 Common Work Results for Plumbing
22 0523 General-Duty Valves for Plumbing Piping
22 0529 Hangers and Supports for Plumbing Piping And Equipment
22 0553 Identification for Plumbing Piping and Equipment
22 0719 Plumbing Piping Insulation
22 1116 Domestic Water Piping
22 1119 Domestic Water Piping Specialties
22 1123.21 Inline, Domestic-Water Pumps
22 1316 Sanitary Waste and Vent Piping
22 1319 Sanitary Waste Piping Specialties
22 1319.13 Sanitary Drains
22 1323 Sanitary Waste Interceptors
22 3100 Domestic Water Softeners
22 3400 Fuel-Fired, Domestic-Water Heaters
22 4200 Commercial Plumbing Fixtures
22 4716 Pressure Water Coolers
23 0523 General-Duty Valves for HVAC Piping
23 0529 Hangers and Supports for HVAC Piping and Equipment
23 0553 Identification for HVAC Piping and Equipment
23 0593 Testing, Adjusting, And Balancing For HVAC
23 0713 Duct Insulation
23 0719 HVAC Piping Insulation
23 0923 Direct Digital Control (DDC) System For HVAC
23 0923.12 Control Dampers
23 1123 Facility Natural-Gas Piping
23 2300 Refrigerant Piping
23 3113 Metal Ducts
23 3300 Air Duct Accessories
23 3346 Flexible Ducts
23 3423 HVAC Power Ventilators
23 3713.13 Air Diffusers
23 3713.23 Registers and Grilles
23 3813 Commercial- Kitchen Hoods
23 5123 Gas Vents
23 5416.13 Gas-Fired Furnaces
23 5533.16 Gas-Fired Unit Heaters
23 7223.23 Packaged, Outdoor, Heat Wheel Energy Recovery Units
23 7223.29 Air-To-Air Energy Recovery Ventilator
23 7416.11 Packaged, Small-Capacity, Rooftop Air-Conditioning Units
23 7433 Dedicated Outdoor-Air Units
23 8126 Split-System Air-Conditioners
26 0519 Low-Voltage Electrical Power Conductors and Cables
26 0526 Grounding and Bonding for Electrical Systems
26 0529 Hangers and Supports for Electrical Systems
26 0533 Raceways and Boxes for Electrical Systems
26 0553 Identification for Electrical Systems

Specifications (continued):

26 0573.19 Arc-Flash Hazard Analysis
26 0923 Lighting Control Devices
26 2416 Panelboards
26 2726 Wiring Devices
26 2816 Enclosed Switches and Circuit Breakers
26 3600 Transfer Switches
26 5000 Lighting
284621.11 Addressable Fire-Alarm Systems



May 31, 2024

SECTION 000107 - PROFESSIONAL SEALS AND CERTIFICATIONS

DENNIS G. GLORE, INC. (FOODSERVICE)
I, Dennis Glore, hereby specify, pursuant to RS MO 327.411, that the documents or instruments relating to be authenticated by my seal are limited to:

Drawings:

Q-FP-01 FOODSERVICE EQUIPMENT FLOOR PLAN
Q-FP-02 FOODSERVICE EQUIPMENT SPOT ELECTRICAL PLAN
Q-FP-03 FOODSERVICE EQUIPMENT SPOT PLUMBING PLAN
Q-DT-01 FOODSERVICE EQUIPMENT ELEVATIONS

Specifications:

11 4000 Foodservice Equipment

END OF SECTION 00 0107

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS INDEX:

SECTION 000115 – LIST OF DRAWINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section provides a comprehensive list of the drawings that comprise the Bid Documents for this project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 LIST OF DRAWINGS

A. The following list of drawings is a part of the Bid Documents:

	TITLE	SHEET #	DATE	CAD #
	GENERAL			
1	COVER SHEET	G001	5/31/2024	T2318-01_6295_8136295004_G001.DWG
2	SHEET LIST	G002	5/31/2024	T2318-01_6295_8136295004_G002.DWG
3	CODE SHEET	G003	5/31/2024	T2318-01_6295_8136295004_G003.DWG
	CIVIL			
4	CIVIL GENERAL INFORMATION	C001	5/31/2024	T2318-01_6295_8136295004_C-001.DWG
5	DEMOLITION PLAN	C100	5/31/2024	T2318-01_6295_8136295004_C-100.DWG
6	EROSION CONTROL PLAN	C101	5/31/2024	T2318-01_6295_8136295004_C-101.DWG
7	GRADING PLAN	C102	5/31/2024	T2318-01_6295_8136295004_C-102.DWG
8	UTILITY PLAN	C103	5/31/2024	T2318-01_6295_8136295004_C-103.DWG
9	STORM SEWER PROFILES & DETAILS	C104	5/31/2024	T2318-01_6295_8136295004_C-104.DWG
10	SITE PLAN	C105	5/31/2024	T2318-01_6295_8136295004_C-105.DWG
11	SITE CONSTRUCTION DETAILS	C500	5/31/2024	T2318-01_6295_8136295004_C-500.DWG
12	FENCE, STAIR & HANDRAIL DETAILS	C501	5/31/2024	T2318-01_6295_8136295004_C-501.DWG
	STRUCTURAL			
13	GENERAL STRUCTURAL DATA	S001	5/31/2024	T2318-01_6295_8136295004_S-001.DWG
14	MRC SLAB PLAN & DETAILS	S101	5/31/2024	T2318-01_6295_8136295004_S-101.DWG
15	MRC ROOF FRAMING PLAN & DETAILS	S201A	5/31/2024	T2318-01_6295_8136295004_S-201A.DWG
16	MRC ROOF FRAMING DETAILS	S201B	5/31/2024	T2318-01_6295_8136295004_S-201B.DWG
17	COLD STORAGE BUILDING PLAN & DETAILS (ALTERNATE #2)	S202	5/31/2024	T2318-01_6295_8136295004_S-202.DWG

	ARCHITECTURAL			
18	MRC BUILDING DEMOLITION PLANS	A101	5/31/2024	T2318-01_6295_8136295004_A101.DWG
19	MRC BUILDING CLERESTORY DEMOLITION ELEVATIONS	A102	5/31/2024	T2318-01_6295_8136295004_A102.DWG
20	MRC BUILDING DEMOLITION PLAN - ROOF	A103	5/31/2024	T2318-01_6295_8136295004_A103.DWG
21	MRC BUILDING NEW WORK FLOOR PLANS	A201	5/31/2024	T2318-01_6295_8136295004_A201.DWG
22	MRC BUILDING REFLECTED CEILING PLAN	A202	5/31/2024	T2318-01_6295_8136295004_A202.DWG
23	MRC BUILDING ROOF PLAN	A203	5/31/2024	T2318-01_6295_8136295004_A203.DWG
24	MRC BUILDING ELEVATIONS	A301	5/31/2024	T2318-01_6295_8136295004_A301.DWG
25	MRC BUILDING ELEVATIONS - EIFS REPAIR	A302	5/31/2024	T2318-01_6295_8136295004_A302.DWG
26	MRC BUILDING SECTIONS	A401	5/31/2024	T2318-01_6295_8136295004_A401.DWG
27	TYPICAL CASEWORK DETAILS & MOUNTING HEIGHTS	A501	5/31/2024	T2318-01_6295_8136295004_A501.DWG
28	ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS	A502	5/31/2024	T2318-01_6295_8136295004_A502.DWG
29	WALL SECTIONS	A601	5/31/2024	T2318-01_6295_8136295004_A601.DWG
30	DETAIL AND PLAN SECTIONS	A602	5/31/2024	T2318-01_6295_8136295004_A602.DWG
31	DOOR & FRAME SCHEDULE, WINDOW SCHEDULE, DOOR DETAILS	A701	5/31/2024	T2318-01_6295_8136295004_A701.DWG
32	FINISH FLOOR PLAN	A702	5/31/2024	T2318-01_6295_8136295004_A702.DWG
33	ROOM FINISH SCHEDULE & INTERIOR FINISH KEY	A703	5/31/2024	T2318-01_6295_8136295004_A703.DWG
34	ALT-NO-2 COLD STORAGE BUILDING DEMOLITION & NEW WORK PLANS	A801	5/31/2024	T2318-01_6295_8136295004_A801.DWG
35	ALT-NO-2 COLD STORAGE BUILDING ELEVATIONS	A802	5/31/2024	T2318-01_6295_8136295004_A802.DWG
36	ALT-NO-3 OLD FMS - DEMO, NEW WORK & RELFECTED CEILING PLANS	A803	5/31/2024	T2318-01_6295_8136295004_A803.DWG
	TITLE	SHEET #	DATE	CAD #
	MECHANICAL			
37	MEP ROOF PLAN	MEP101	5/31/2024	T2318-01\6295\8136295004\MEP101.DWG
38	MECHANICAL NOTES, SPECIFICATIONS, AND LEGENDS	M000	5/31/2024	T2318-01\6295\8136295004\M000.DWG
39	MAIN BUILDING MECHANICAL DEMO PLAN	MD101	5/31/2024	T2318-01\6295\8136295004\MD101.DWG
40	ALTERNATE NO. 3 OUT BUILDINGS MECHANICAL DEMO PLAN	MD201	5/31/2024	T2318-01\6295\8136295004\MD201.DWG
41	MAIN BUILDING MECHANICAL PLAN	M101	5/31/2024	T2318-01\6295\8136295004\M101.DWG
42	ALTERNATE NO. 3 OUT BUILDINGS MECHANICAL PLAN	M201	5/31/2024	T2318-01\6295\8136295004\M201.DWG
43	MECHANICAL SECTIONS	M301	5/31/2024	T2318-01\6295\8136295004\M301.DWG
44	MECHANICAL DETAILS	M501	5/31/2024	T2318-01\6295\8136295004\M501.DWG
45	MECHANICAL DETAILS	M502	5/31/2024	T2318-01\6295\8136295004\M502.DWG
46	MECHANICAL SCHEDULES	M601	5/31/2024	T2318-01\6295\8136295004\M601.DWG
47	MECHANICAL SCHEDULES	M602	5/31/2024	T2318-01\6295\8136295004\M602.DWG
48	KITCHEN HOOD DRAWINGS	M603	5/31/2024	T2318-01\6295\8136295004\M603.DWG
49	KITCHEN HOOD DRAWINGS	M604	5/31/2024	T2318-01\6295\8136295004\M604.DWG
50	KITCHEN HOOD AND EXHAUST FAN DRAWINGS	M605	5/31/2024	T2318-01\6295\8136295004\M605.DWG
51	KITCHEN DOAS DRAWINGS	M606	5/31/2024	T2318-01\6295\8136295004\M606.DWG
52	KITCHEN DOAS DRAWINGS	M607	5/31/2024	T2318-01\6295\8136295004\M607.DWG
53	KITCHEN ELECTRICAL SCHEMATIC	M608	5/31/2024	T2318-01\6295\8136295004\M608.DWG
54	KITCHEN ELECTRICAL SCHEMATIC	M609	5/31/2024	T2318-01\6295\8136295004\M609.DWG
55	KITCHEN LOW VOLTAGE DRAWINGS	M610	5/31/2024	T2318-01\6295\8136295004\M610.DWG

	ELECTRICAL			
56	ELECTRICAL NOTES, SPECIFICATIONS, AND LEGENDS	E000	5/31/2024	T2318-01\6295\8136295004\E000.DWG
57	ELECTRICAL DEMO PLAN	ED101	5/31/2024	T2318-01\6295\8136295004\ED101.DWG
58	ALTERNATE NO. 3 OUT BUILDINGS ELECTRICAL DEMO PLAN	ED201	5/31/2024	T2318-01\6295\8136295004\ED201.DWG
59	MAIN BUILDING ELECTRICAL LIGHTING PLAN	EL101	5/31/2024	T2318-01\6295\8136295004\EL101.DWG
60	ALTERNATE NO. 3 OUT BUILDINGS ELECTRICAL LIGHTING PLAN	EL201	5/31/2024	T2318-01\6295\8136295004\EL201.DWG
61	MAIN BUILDING ELECTRICAL POWER PLAN	EP101	5/31/2024	T2318-01\6295\8136295004\EP101.DWG
62	ALTERNATE NO. 3 OUT BUILDINGS ELECTRICAL POWER PLAN	EP201	5/31/2024	T2318-01\6295\8136295004\EP201.DWG
63	ELECTRICAL SITE PLAN	EP202	5/31/2024	T2318-01\6295\8136295004\EP202.DWG
64	ELECTRICAL DETAILS	E501	5/31/2024	T2318-01\6295\8136295004\E501.DWG
65	ELECTRICAL SCHEDULES	E601	5/31/2024	T2318-01\6295\8136295004\E601.DWG
	PLUMBING			
66	PLUMBING NOTES, SPECIFICATIONS, AND LEGENDS	P000	5/31/2024	T2318-01\6295\8136295004\P000.DWG
67	MAIN BUILDING PLUMBING DEMO PLAN	PD101	5/31/2024	T2318-01\6295\8136295004\PD101.DWG
68	ALTERNATE NO. 3 OUT BUILDINGS PLUMBING DEMO PLAN	PD201	5/31/2024	T2318-01\6295\8136295004\PD201.DWG
69	MAIN BUILDING PLUMBING PLAN	P101	5/31/2024	T2318-01\6295\8136295004\P101.DWG
70	ALTERNATE NO. 3 OUT BUILDINGS PLUMBING PLAN	P201	5/31/2024	T2318-01\6295\8136295004\P201.DWG
71	MAIN BUILDING PLUMBING PLANS ENLARGED	P401	5/31/2024	T2318-01\6295\8136295004\P401.DWG
72	PLUMBING DETAILS	P501	5/31/2024	T2318-01\6295\8136295004\P501.DWG
73	PLUMBING DETAILS	P502	5/31/2024	T2318-01\6295\8136295004\P502.DWG
74	PLUMBING SCHEDULES AND RISER	P601	5/31/2024	T2318-01\6295\8136295004\P601.DWG
	FOODSERVICE			
75	FOODSERVICE EQUIPMENT FLOOR PLAN	Q-FP-01	5/31/2024	T2318-01_6295_8136295004_Q-FP-01.DWG
76	FOODSERVICE EQUIPMENT SPOT ELECTRICAL PLAN	Q-FP-02	5/31/2024	T2318-01_6295_8136295004_Q-FP-02.DWG
77	FOODSERVICE EQUIPMENT SPOT PLUMBING PLAN	Q-FP-03	5/31/2024	T2318-01_6295_8136295004_Q-FP-03.DWG
78	FOODSERVICE EQUIPMENT ELEVATIONS	Q-DT-01	5/31/2024	T2318-01_6295_8136295004_Q-DT-01.DWG

END OF SECTION 000115

SECTION 001116 - INVITATION FOR BID

1.0 OWNER:

A. The State of Missouri
Office of Administration,
Division of Facilities Management, Design and Construction
Jefferson City, Missouri

2.0 PROJECT TITLE AND NUMBER:

A. Renovate Interior & Exterior Readiness Center Building
Mexico Readiness Center
Mexico, Missouri
Project No.: T2318-01

3.0 BIDS WILL BE RECEIVED:

A. Until: 1:30 PM, August 27, 2024

B. **Only electronic bids on MissouriBUYS shall be accepted: https://missouribuys.mo.gov. Bidder must be registered to bid.**

4.0 DESCRIPTION:

A. Scope: The project consists of interior and exterior renovation of the Mexico Readiness Center.

B. MBE/WBE/SDVE Goals: MBE 10%, WBE 10%, and SDVE 3%**. NOTE: Only MBE/WBE firms certified by the State of Missouri Office of Equal Opportunity as of the date of bid opening, or SDVE(s) meeting the requirements of Section 34.074, RSMo and 1 CSR 30-5.010, can be used to satisfy the MBE/WBE/SDVE participation goals for this project.**

C. **NOTE: Bidders are provided new Good Faith Effort (GFE) forms on MissouriBUYS.

5.0 PRE-BID MEETING:

A. Place/Time**:** 10 AM, August 13, 2024, at Mexico Readiness Center, 917 West Curtis Street, Mexico, Missouri

B. Access to State of Missouri property requires presentation of a photo ID by all persons

6.0 HOW TO GET PLANS & SPECIFICATIONS:

A. View Only Electronic bid sets are available at no cost or paper bid sets for a deposit of $100.00 from American Document Solutions (ADS). MAKE CHECKS PAYABLE TO: American Document Solutions. Mail to: American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433, https://www.adsplanroom.net. NOTE: Prime contractors will be allowed a maximum of two bid sets at the deposit rate shown above. Other requesters will be allowed only one bid set at this rate. Additional bid sets or parts thereof may be obtained by any bidder at the cost of printing and shipping by request to American Document Solutions at the address shown above. **Bidder must secure at least one bid set to become a planholder.**

B. **Refunds: Return plans and specifications in unmarked condition within 15 working days of bid opening to American Document Solutions, 1400 Forum Blvd., Suite 7A, Columbia, Missouri 65203. Phone 573-446-7768, Fax 573-355-5433. Deposits for plans not returned within 15 working days shall be forfeited.**

C. Information for upcoming bids, including downloadable plans, specifications, Invitation for Bid, bid tabulation, award, addenda, and
access to the ADS planholders list, is available on the Division of Facilities Management, Design and Construction's web site: https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans.

7.0 POINT OF CONTACT:

A. Designer: SOA Architecture, Jennifer M. Hedrick, 573-443-1407, email: hedrick@soa-inc.com

B. Project Manager: Sandra Walther, 573-257-7322, email: sandra.walther@oa.mo.gov

8.0 GENERAL INFORMATION:

A. The State reserves the right to reject any and all bids and to waive all informalities in bids. No bid may be withdrawn for a period of 20 working days subsequent to the specified bid opening time. The contractor shall pay not less than the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed, as determined by the Missouri Department of Labor and Industrial Relations and as set out in the detailed plans and specifications.

B. Bid results will be available at https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans after it is verified that at least one bid is awardable and affordable.

Very Important MissouriBUYS Instructions to Help Submit a Bid Correctly

A. The bidder shall submit his or her bid and all supporting documentation on MissouriBUYS eProcurement System. No hard copy bids shall be accepted. Go to https://missouribuys.mo.gov and register. The bidder must register and complete a profile fully with all required documents submitted prior to submitting a bid.

B. Once registered, log in.

1. Under "Solicitation" select "View Current Solicitations."
2. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8", then click "Filter Solicitation" button.
3. Select "Active Solicitations" tab.
4. To see the Solicitation Summary, click on the Project Number and the summary will open. Click each heading to open detailed information.

C. Here are simplified instructions for uploading the bid to MissouriBUYS:

1. Find the solicitation by completing Steps 1 through 4 above.
2. Select the three dots under "Actions." Select "Add New Response."
3. When the Quote box opens, give the response a title and select "OK."
4. The detailed solicitation will open. Select "Check All" for the Original Solicitation Documents, open each document, and select "Accept." If this step is not completed, a bid cannot be uploaded. Scroll to the bottom of the page and select "Add Attachments." If you do not see this command, not all documents have been opened and accepted.
5. The Supplier Attachments box will open. Select "Add Attachment" again.
6. The Upload Documents box will open. Read the instructions for uploading. Disregard the "Confidential" check box.
7. Browse and attach up to 5 files at a time. Scroll to bottom of box and select "Upload." The Supplier Attachments box will open. Repeat Steps 5 through 7 if more than 5 files are to be uploaded.
8. When the Supplier Attachments box opens again and uploading is complete, select "Done." A message should appear that the upload is successful. If it does not, go to the Bidder Response tab and select "Submit."
9. The detailed solicitation will open. At the bottom select "Close."

D. Any time a bidder wants to modify the bid, he or she will have to submit a new one. FMDC will open the last response the bidder submits. The bidder may revise and submit the bid up to the close of the solicitation (bid date and time). Be sure to allow for uploading time so that the bid is successfully uploaded prior to the 1:30 PM deadline; we can only accept the bid if it is uploaded before the deadline.

E. If you want to verify that you are uploading documents correctly, please contact Paul Girouard: 573-751-4797, paul.girouard@oa.mo.gov ; April Howser: 573-751-0053, April.Howser@oa.mo.gov ; or Mandy Roberson: 573-522-0074, Mandy.Roberson@oa.mo.gov.

F. If you are experiencing login issues, please contact Web Procure Support (Proactis) at 866-889-8533 anytime from 7:00 AM to 7:00 PM Central Time, Monday through Friday. If you try using a userid or password several times that is incorrect, the system will lock you out. Web Procure Support is the only option to unlock you! If you forget your userid or password, Web Procure Support will provide a temporary userid or password. Also, if it has been a while since your last successful login and you receive an "inactive" message, contact Web Procure (Proactis). If you are having a registration issue, you may contact Cathy Holliday at 573-751-3491 or by email: cathy.holliday@oa.mo.gov.

IMPORTANT REMINDER REGARDING REQUIREMENT FOR OEO CERTIFICATION

A. SECTION 002113 – INSTRUCTIONS TO BIDDERS: Article 15.0, Section D1:

As of July 1, 2020, all MBE, WBE, and MBE/WBE contractors, subcontractors, and suppliers must be certified by the State of Missouri, Office of Equal Opportunity. No certifications from other Missouri certifying agencies will be accepted.

SECTION 002113 – INSTRUCTIONS TO BIDDERS

1.0 - SPECIAL NOTICE TO BIDDERS

A. If awarded a contract, the Bidder's employees, and the employees of all subcontractors, who perform the work on the project must adhere to requirements in Section 013513 – Site Security and Health Requirements as applicable per Agency.

B. The Bidder's prices shall include all city, state, and federal sales, excise, and similar taxes that may lawfully be assessed in connection with the performance of work, and the purchased of materials to be incorporated in the work. THIS PROJECT IS NOT TAX EXEMPT.

2.0 - BID DOCUMENTS

A. The number of sets obtainable by any one (1) party may be limited in accordance with available supply.

B. For the convenience of contractors, sub-contractors and suppliers, copies of construction documents are on file at the office of the Director, Division of Facilities Management, Design and Construction and on the Division's web site - https://oa.mo.gov/facilities/bid-opportunities/bid-listing-electronic-plans.

3.0 - BIDDERS' OBLIGATIONS

A. Bidders must carefully examine the entire site of the work and shall make all reasonable and necessary investigations to inform themselves thoroughly as to the facilities available as well as to all the difficulties involved in the completion of all work in accordance with the specifications and the plans. Bidders are also required to examine all maps, plans and data mentioned in the specifications. No plea of ignorance concerning observable existing conditions or difficulties that may be encountered in the execution of the work under this contract will be accepted as an excuse for any failure or omission on the part of the contractor to fulfill in every detail all of the requirements of the contract, nor accepted as a basis for any claims for extra compensation.

B. Under no circumstances will contractors give their plans and specifications to another contractor. Any bid received from a contractor whose name does not appear on the list of plan holders may be subject to rejection.

4.0 - INTERPRETATIONS

A. No bidder shall be entitled to rely on oral interpretations as to the meaning of the plans and specifications or the acceptability of alternate products, materials, form or type of construction. Every request for interpretation shall be made in writing and submitted with all supporting documents not less than five (5) working days before opening of bids. Every interpretation made to a bidder will be in the form of an addendum and will be sent as promptly as is practicable to all persons to whom plans and specifications have been issued. All such addenda shall become part of the contract documents.

B. Approval for an "acceptable substitution" issued in the form of an addendum as per Paragraph 4A above, and as per Article 3.1 of the General Conditions; ACCEPTABLE SUBSTITUTIONS shall constitute approval for use in the project of the product.

C. An "acceptable substitution" requested after the award of bid shall be approved if proven to the satisfaction of the Owner and the Designer as per Article 3.1, that the product is acceptable in design, strength, durability, usefulness, and convenience for the purpose intended. Approval of the substitution after award is at the sole discretion of the Owner.

D. A request for "Acceptable Substitutions" shall be made on the Section 006325 Substitution Request Form. The request shall be sent directly to the project Designer. A copy of said request should also be mailed to the Owner, Division of Facilities Management, Design and Construction, Post Office Box 809, Jefferson City, Missouri 65102.

5.0 - BIDS AND BIDDING PROCEDURE

A. Bidders shall submit all submission forms and accompanying documents listed in SECTION 004113 – BID FORM, Article 5.0, ATTACHMENTS TO BID by the stated time or their bid will be rejected for being non-responsive.

Depending on the specific project requirements, **the following is a GENERIC list** of all possible bid forms that may be due with bid submittals and times when they may be due. Please check for specific project requirements on the proposal form (Section 004113). ***Not all of the following bid forms may be required to be submitted.***

Bid Submittal – due before stated date and time of bid opening (see IFB):

004113	Bid Form (all pages are always required)
004322	Unit Prices Form
004336	Proposed Subcontractors Form
004337	MBE/WBE/SDVE Compliance Evaluation Form
004338	MBE/WBE/SDVE Eligibility Determination for Joint Ventures
004339	MBE/WBE/SDVE GFE Determination
004340	SDVE Business Form
004541	Affidavit of Work Authorization
004545	Anti-Discrimination Against Israel Act Certification form

B. All bids shall be submitted without additional terms and conditions, modification or reservation on the bid forms with each space properly filled. Bids not on these forms will be rejected.

C. All bids shall be accompanied by a bid bond executed by the bidder and a duly authorized surety company, certified check, cashier's check or bank draft made payable to the Division of Facilities Management, Design and Construction, State of Missouri, in the amount indicated on the bid form, Section 004113. Failure of the contractor to submit the full amount required shall be sufficient cause to reject his bid. The bidder agrees that the proceeds of the check, draft or bond shall become the property of the State of Missouri, if for any reason the bidder withdraws his bid after closing, or if on notification of award refuses or is unable to execute tendered contract, provide an acceptable performance and payment bond, provide evidence of required insurance coverage and/or provide required copies of affirmative action plans within ten (10) working days after such tender.

D. The check or draft submitted by the successful bidder will be returned after the receipt of an acceptable performance and payment bond and execution of the formal contract. Checks or drafts of all other bidders will be returned within a reasonable time after it is determined that the bid represented by same will receive no further consideration by the State of Missouri. Bid bonds will only be returned upon request.

6.0 - SIGNING OF BIDS

A. A bid from an individual shall be signed as noted on the Bid Form.

B. A bid from a partnership or joint venture shall require only one signature of a partner, an officer of the joint venture authorized to bind the venture or an attorney-in-fact. If the bid is signed by an officer of a joint venture or an attorney-in-fact, a document evidencing the individual's authority to execute contracts should be included with the bid form.

C. A bid from a limited liability company (LLC) shall be signed by a manager or a managing member of the LLC.

D. A bid from a corporation shall have the correct corporate name thereon and the signature of an authorized officer of the corporation manually written. Title of office held by the person signing for the corporation shall appear, along with typed name of said individual. Corporate license number shall be provided and, if a corporation organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached. In addition, for corporate proposals, the President or Vice-President should sign as the bidder. If the signatory is other than the corporate president or vice president, the bidder must provide satisfactory evidence that the signatory has the legal authority to bind the corporation.

E. A bid should contain the full and correct legal name of the Bidder. If the Bidder is an entity registered with the Missouri Secretary of State, the Bidder's name on the bid form should appear as shown in the Secretary of State's records.

F. The Bidder should include its corporate license number on the Bid Form and, if the corporation is organized in a state other than Missouri, a Certificate of Authority to do business in the State of Missouri shall be attached to the bid form.

7.0 - RECEIVING BID SUBMITTALS

A. It is the bidder's sole responsibility to assure receipt by Owner of bid submittals by the date and time specified in the Invitation for Bid. Bids received after the date and time specified shall not be considered by the Owner.

B. Bids must be submitted through the MissouriBUYS statewide eProcurement system (https://www.missouribuys.mo.gov/) in accordance with the instructions for that system. The Owner shall only accept bids submitted through MissouriBUYS. Bids received by the Owner through any other means, including hard copies, shall not be considered and will be discarded by the Owner unopened.

C. To respond to an Invitation for Bid, the Bidder must first register with MissouriBUYS by going through the MissouriBUYS Home Page (https://www.missouribuys.mo.gov/), clicking the "Register" button at the top of the page, and completing the Vendor Registration. Once registered, the Bidder accesses its account by clicking the "Login" button at the top of the MissouriBUYS Home Page. Enter your USERID and PASSWORD, which the Bidder will select. Under Solicitations, select "View Current Solicitations." A new screen will open. Under "Filter by Agency" select "OA-FMDC-Contracts Chapter 8." Under "Filter by Opp. No." type in the State Project Number. Select "Submit." Above the dark blue bar, select "Other Active Opportunities." To see the Solicitation Summary, single click the Opp. No. (Project Number) and the summary will open. Single quick click each blue bar to open detailed information. The Bidder must read and accept the Original Solicitation Documents and complete all identified requirements. The Bidder should download and save all of the Original Solicitation Documents on its computer so that the Bidder can prepare its response to these documents. The Bidder should upload its completed response to the downloaded documents as an attachment to the electronic solicitation response.

D. Step-by-step instructions for how a registered vendor responds to a solicitation electronically are provided in Section 001116 – Invitation For Bid.

E. The Bidder shall submit its bid on the forms provided by the Owner on MissouriBUYS with each space fully and properly completed, including all amounts required for alternate bids, unit prices, cost accounting data, etc. The Owner may reject bids that are not on the Owner's forms or that do not contain all requested information.

F. No Contractor shall stipulate in his bid any conditions not contained in the specifications or standard bid form contained in the contract documents. To do so may subject the Contractor's bid to rejection.

G. The completed forms shall be without interlineations, alterations or erasures.

8.0 - MODIFICATION AND WITHDRAWAL OF BIDS

A. Bidder may withdraw his bid at any time prior to scheduled closing time for receipt of bids, but no bidder may withdraw his bid for a period of twenty (20) working days after the scheduled closing time for receipt of bids.

B. The Bidder shall modify his or her original bid by submitting a revised bid on MissouriBUYS.

9.0 - AWARD OF CONTRACT

A. The Owner reserves the right to reject any and/or all bids and further to waive all informalities in bidding when deemed in the best interest of the State of Missouri.

B. The Owner reserves the right to let other contracts in connection with the work, including but not by way of limitation, contracts for the furnishing and installation of furniture, equipment, machines, appliances and other apparatus.

C. The Owner shall award a contract to the lowest, responsive, responsible Bidder in accordance with Section 8.250, RSMo. No contract will be awarded to any Bidder who has had a contract with the Owner terminated within the preceding twelve months for material breach of contract or who has been suspended or debarred by the Owner.

D. Award of alternates, if any, will be made in numerical order unless all bids received are such that the order of acceptance of alternates does not affect the determination of the lowest, responsive, responsible bidder.

E. No bid shall be considered binding upon the Owner until the written contract has been properly executed, a satisfactory bond has been furnished, evidence of required insurance coverage, submittal of executed Section 004541, Affidavit of Work Authorization form, documentation evidencing enrollment and participation in a federal work authorization program has been received and an affirmative action plan submitted. Failure to execute and return the contract and associated documents within the prescribed period of time shall be treated, at the option of the Owner, as a breach of bidder's obligation and the Owner shall be under no further obligation to bidder.

F. If the successful bidder is doing business in the State of Missouri under a fictitious name, he shall furnish to Owner, attached to the Bid Form, a properly certified copy of the certificate of Registration of Fictitious Name from the State of Missouri, and such certificate shall remain on file with the Owner.

G. Any successful bidder which is a corporation organized in a state other than Missouri shall furnish to the Owner, attached to the Bid Form, a properly certified copy of its current Certificate of Authority to do business in the State of Missouri, such certificate to remain on file with the Owner. No contract will be awarded by the Owner unless such certificate is furnished by the bidder.

H. Any successful bidder which is a corporation organized in the State of Missouri shall furnish at its own cost to the Owner, if requested, a Certificate of Good Standing issued by the Secretary of State, such certificate to remain on file with the Owner.

I. Transient employers subject to Sections 285.230 and 285.234, RSMo, (out-of-state employers who temporarily transact any business in the State of Missouri) may be required to file a bond with the Missouri Department of Revenue. No contract will be awarded by the Owner unless the successful bidder certifies that he has complied with all applicable provisions of Section 285.230-234.

J. Sections 285.525 and 285.530, RSMo, require business entities to enroll and participate in a federal work authorization program in order to be eligible to receive award of any state contract in excess of $5,000. Bidders should submit with their bid an Affidavit of Work Authorization (Section 004541) along with appropriate documentation evidencing such enrollment and participation. Section-004541, Affidavit of Work Authorization is located on the MissouriBUYS solicitation for this project. Bidders must also submit an E-Verify Memorandum before the Owner may award a contract to the Bidder. Information regarding a E-Verify is located at https://www.uscis.gov/e-verify/. The contractor shall be responsible for ensuring that all subcontractors and suppliers associated with this contract enroll in E-Verify.

10.0 - CONTRACT SECURITY

A. The successful bidder shall furnish a performance/payment bond as set forth in General Conditions Article 6.1 on a condition prior to the State executing the contract and issuing a notice to proceed.

11.0 - LIST OF SUBCONTRACTORS

A. If required by "Section 004113 – Bid Form," each bidder must submit as part of their bid a list of subcontractors to be used in performing the work (Section 004336). The list must specify the name of the single designated subcontractor, for each category of work listed in "Section 004336 - Proposed Subcontractors Form." If work within a category will be performed by more than one subcontractor, the bidder must provide the name of each subcontractor and specify the exact portion of the work to be done by each. Failure to list the Bidder's firm, or a subcontractor for each category of work identified on the Bid Form or the listing of more than one subcontractor for any category without designating the portion of work to be performed by each shall be cause for rejection of the bid. If the bidder intends to perform any of the designated subcontract work with the use of his own employees, the bidder shall make that fact clear, by listing his own firm for the subject category. **If any category of work is left vacant, the bid shall be rejected.**

12.0 - WORKING DAYS

A. Contract duration time is stated in working days and will use the following definition in determining the actual calendar date for contract completion:

1. Working days are defined as all calendar days except Saturdays, Sundays and the following State of Missouri observed holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday, Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day.

13.0 - AMERICAN AND MISSOURI - MADE PRODUCTS AND FIRMS

A. By signing the bid form and submitting a bid on this project, the Bidder certifies that it will use American and Missouri products as set forth in Article 1.7 of the General Conditions. Bidders are advised to review those requirements carefully prior to bidding.

B. A preference shall be given to Missouri firms, corporations or individuals, or firms, corporations or individuals that maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less.

C. Pursuant to Section 34.076, RSMo, a contractor or Bidder domiciled outside the boundaries of the State of Missouri shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor or Bidder domiciled in Missouri as would be required for such a Missouri domiciled contractor or Bidder to succeed over the bidding contractor or Bidder domiciled outside Missouri on a like contract or bid being let in the person's domiciliary state and, further, the contractor or Bidder domiciled outside the boundaries of Missouri shall be required to submit an audited financial statement as would be required of a Missouri domiciled contractor or Bidder on a like contract or bid being let in the domiciliary state of that contractor or Bidder.

14.0 – ANTI-DISCRIMINATION AGAINST ISRAEL ACT CERTIFICATION:

A. Pursuant to section 34.600, RSMo, if the Bidder meets the section 34.600, RSMo, definition of a "company" and the Bidder has ten or more employees, the Bidder must certify in writing that the Bidder is not currently engaged in a boycott of goods or services from the State of Israel as defined in section 34.600, RSMo, and shall not engage in a boycott of goods or services from the State of Israel, if awarded a contract, for the duration of the contract. The Bidder is requested to complete and submit the applicable portion of Section 004545 - Anti-Discrimination Against Israel Act Certification with their Bid Form. The applicable portion of the exhibit must be submitted prior to execution of a contract by the Owner and issuance of Notice to Proceed. If the exhibit is not submitted, the Owner shall rescind its Intent to Award and move to the next lowest, responsive, responsible bidder.

15.0 - MBE/WBE/SDVE INSTRUCTIONS

A. Definitions:

1. **"MBE"** means a Minority Business Enterprise.

2. **"MINORITY"** has the same meaning as set forth in 1 C.S.R. 10-17.010.

3. **"MINORITY BUSINESS ENTERPRISE"** has the same meaning as set forth in section 37.020, RSMo.

4. **"WBE"** means a Women's Business Enterprise.

5. **"WOMEN'S BUSINESS ENTERPRISE"** has the same meaning as set forth in section 37.020, RSMo.

6. **"SDVE"** means a Service-Disabled Veterans Enterprise.

7. **"SERVICE-DISABLED VETERAN"** has the same meaning as set forth in section 34.074, RSMo.

8. **"SERVICE-DISABLED VETERAN ENTERPRISE"** has the same meaning as "Service-Disabled Veteran Business" set forth in section 34.074, RSMo.

B. MBE/WBE/SDVE General Requirements:

1. For all bids greater than $100,000, the Bidder shall obtain MBE, WBE and SDVE participation in an amount equal to or greater than the percentage goals set forth in the Invitation for Bid and the Bid Form, unless the Bidder is granted a Good Faith Effort waiver by the Director of the Division, as set forth below. If the Bidder does not meet the MBE, WBE and SDVE goals, or make a good faith effort to do so, the Bidder shall be non-responsive, and its bid shall be rejected.

2. The Bidder should submit with its bid all of the information requested in the MBE/WBE/SDVE Compliance Evaluation Form for every MBE, WBE, or SDVE subcontractor or material supplier the Bidder intends to use for the contract work. The Bidder is required to submit all appropriate MBE/WBE/SDVE documentation before the stated time and date set forth in the Invitation for Bid. If the Bidder fails to provide such information by the specified date and time, the Owner shall reject the bid.

3. The Director reserves the right to request additional information from a Bidder to clarify the Bidder's proposed MBE, WBE, and/or SDVE participation. The Bidder shall submit the clarifying information requested by the Owner within two (2) Working Days of receiving the request for clarification.

4. Pursuant to section 34.074, RSMo, a Bidder that is a SDVE doing business as Missouri firm, corporation, or individual, or that maintains a Missouri office or place of business, shall receive a three-point bonus preference in the contract award evaluation process. The bonus preference will be calculated and applied by reducing the bid amount of the eligible SDVE by three percent of the apparent low responsive bidder's bid. Based on this calculation, if the eligible SDVE's evaluation is less than the apparent low responsive bidder's bid, the eligible SDVE's bid becomes the apparent low responsive bid. This reduction is for evaluation purposes only, and will have no impact on the actual amount(s) of the bid or the amount(s) of any contract awarded. In order to be eligible for the SDVE preference, the Bidder must complete and submit with its bid the Missouri Service Disabled Veteran Business Form, and any information required by the form. The form is available on the MissouriBUYS solicitation for this project.

C. Computation of MBE/WBE/SDVE Goal Participation:

1. A Bidder who is a MBE, WBE, or SDVE may count 100% of the contract towards the MBE, WBE or SDVE goal, less any amounts awarded to another MBE, WBE or SDVE. (NOTE: A MBE firm that bids as general contractor must obtain WBE and SDVE participation; a WBE firm that bids as a general contractor must obtain MBE and SDVE participation; and a SDVE firm that bids as general contractor must obtain MBE and WBE participation.) In order for the remaining contract amount to be counted towards the MBE, WBE or SDVE goal, the Bidder must complete the MBE/WBE/SDVE Compliance Evaluation Form (Section 004337) identifying itself as an MBE, WBE or SDVE.

2. The total dollar value of the work granted to a certified MBE, WBE or SDVE by the Bidder shall be counted towards the applicable goal.

3. Expenditures for materials and supplies obtained from a certified MBE, WBE, or SDVE supplier or manufacturer may be counted towards the MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE assumes the actual and contractual responsibility for the provision of the materials and supplies.

4. The total dollar value of the work granted to a second or subsequent tier subcontractor or a supplier may be counted towards a Bidder's MBE, WBE and SDVE goals, if the MBE, WBE, or SDVE properly assumes the actual and contractual responsibility for the work.

5. The total dollar value of work granted to a certified joint venture equal to the percentage of the ownership and control of the MBE, WBE, or SDVE partner in the joint venture may be counted towards the MBE/WBE/SDVE goals.

6. Only expenditures to a MBE, WBE, or SDVE that performs a commercially useful function in the work may be counted towards the MBE, WBE and SDVE goals. A MBE, WBE, or SDVE performs a commercially useful function when it is responsible for executing a distinct element of the work and carrying out its responsibilities by actually performing, managing and supervising the work or providing supplies or manufactured materials.

D. Certification of MBE/WBE/SDVE Subcontractors:

1. In order to be counted towards the goals, an MBE or WBE must be certified by the State of Missouri Office of Equal Opportunity and an SDVE must be certified by the State of Missouri, Office of Administration, Division of Purchasing and Material Management or by the Department of Veterans Affairs.

2. The Bidder may determine the certification status of a proposed MBE or WBE subcontractor or supplier by referring to the Office of Equal Opportunity (OEO)'s online MBE/WBE directory (https://apps1.mo.gov/MWBCertifiedFirms/). The Bidder may determine the eligibility of a SDVE subcontractor or supplier by referring to the Division of Purchasing and Materials Management's online SDVE directory (https://oeo.mo.gov/sdve-certification-program/) or the Department of Veterans Affairs' directory (https://veterans.certify.sba.gov/#search).

3. Additional information, clarifications, etc., regarding the listings in the directories may be obtained by calling the Division at (573)751-3339 and asking to speak to the Contract Specialist of record as shown in the Supplementary Conditions (Section 007300).

E. Waiver of MBE/WBE/SDVE Participation:

1. If a Bidder has made a good faith effort to secure the required MBE, WBE and/or SDVE participation and has failed, the Bidder shall submit with its bid the information requested in MBE/WBE/SDVE Good Faith Effort (GFE) Determination form. The GFE forms are located on the MissouriBUYS solicitation for this project. The Director will determine if the Bidder made a good faith effort to meet the applicable goals. If the Director determines that the Bidder did not make a good faith effort, the bid shall be rejected as being nonresponsive to the bid requirements. Bidders who demonstrate that they have made a good faith effort to include MBE, WBE, and/or SDVE participation will be determined to be responsive to the applicable participation goals, regardless of the percent of actual participation obtained, if the bid is otherwise acceptable.

2. In determining whether a Bidder has made a good faith effort to obtain MBE, WBE and/or SDVE participation, the Director may evaluate the factors set forth in 1 CSR 30-5.010(6)(C) and the following:
   a. The amount of actual participation obtained;
   b. How and when the Bidder contacted potential MBE, WBE, and SDVE subcontractors and suppliers;
   c. The documentation provided by the Bidder to support its contacts, including whether the Bidder provided the names, addresses, phone numbers, and dates of contact for MBE/WBE/SDVE firms contacted for specific categories of work;
   d. If project information, including plans and specifications, were provided to MBE/WBE/SDVE subcontractors;
   e. Whether the Bidder made any attempts to follow-up with MBE, WBE or SDVE firms prior to bid;
   f. Amount of bids received from any of the subcontractors and/or suppliers that the Bidder contacted;
   g. The Bidder's stated reasons for rejecting any bids;

3. If no bidder has obtained any participation in a particular category (MBE/WBE/SDVE) or made a good faith effort to do so, the Director may waive that goal rather than rebid.

F. Contractor MBE/WBE/SDVE Obligations

1. If awarded a contract, the Bidder will be contractually required to subcontract with or obtain materials from the MBE, WBE, and SDVE firms listed in its bid, in amounts equal to or greater than the dollar amount bid, unless the amount is modified in writing by the Owner.

2. If the Contractor fails to meet or maintain the participation requirements contained in the Contractor's bid, the Contractor must satisfactorily explain to the Director why it cannot comply with the requirement and why failing meeting the requirement was beyond the Contractor's control. If the Director finds the Contractor's explanation unsatisfactory, the Director may take any appropriate action including, but not limited to:

    a. Declaring the Contractor ineligible to participate in any contracts with the Division for up to twelve (12) months (suspension); and/or

    b. Declaring the Contractor be non-responsive to the Invitation for Bid, or in breach of contract and rejecting the bid or terminating the contract.

3. If the Contractor replaces an MBE, WBE, or SDVE during the course of this contract, the Contractor shall replace it with another MBE, WBE, or SDVE or make a good faith effort to do so. All MBE, WBE and SDVE substitutions must be approved by the Director.

4. The Contractor shall provide the Owner with regular reports on its progress in meeting its MBE/WBE/SDVE obligations. At a minimum, the Contractor shall report the dollar-value of work completed by each MBE, WBE, or SDVE during the preceding month and the cumulative total of work completed by each MBE, WBE or SDVE to date with each monthly application for payment. The Contractor shall also make a final report, which shall include the total dollar-value of work completed by each MBE, WBE, and SDVE during the entire contract.

STATE OF MISSOURI
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
MBE/WBE/SDVE DIRECTORIES

The MBE/WBE Directory for goods and services is maintained by the Office of Equal Opportunity (OEO) and is located at the following web address:

https://apps1.mo.gov/MWBCertifiedFirms/

The SERVICE DISABLED VETERAN ENTERPRISE (SDVE) Directories may be accessed at the following web addresses:

https://oeo.mo.gov/sdve-certification-program/

https://veterans.certify.sba.gov/#search

State of Missouri Construction Contract

THIS AGREEMENT is made (DATE) by and between:

Contractor Name and Address

hereinafter called the "Contractor,"

and the **State of Missouri**, hereinafter called the **"Owner**", represented by the Office of Administration, Division of Facilities Management, Design and Construction.

WITNESSETH, that the Contractor and the Owner, for the consideration stated herein agree as follows:

ARTICLE 1. STATEMENT OF WORK

The Contractor shall furnish all labor and materials and perform all work required for furnishing and installing all labor, materials, equipment and transportation and everything necessarily inferred from the general nature and tendency of the plans and specifications for the proper execution of the work for:

Project Name:	**Renovate Interior & Exterior Readiness Center Building** **Mexico Readiness Center** **Mexico, Missouri**
Project Number:	**T2318-01**

in strict accordance with the Contract Documents as enumerated in Article 7, all of which are made a part hereof.

ARTICLE 2. TIME OF COMPLETION

The contract performance time is **240 working days** from the transmittal date of this agreement. The contract completion date is **MONTH, DAY, YEAR**. This time includes ten (10) working days for the Contractor to receive, sign and return the contract form along with required bonding and insurance certificates. Failure of the Contractor to provide correct bonding and insurance within the ten (10) working days shall not be grounds for a time extension. Receipt of proper bonding and insurance is a condition precedent to the formation of the contract and if not timely received, may result in forfeiture of the Contractor's bid security. Work may not commence until the Owner issues a written Notice to Proceed and must commence within seven (7) working days thereafter.

ARTICLE 3. LIQUIDATED DAMAGES

Whenever time is mentioned in this contract, time shall be and is of the essence of this contract. The Owner would suffer a loss should the Contractor fail to have the work embraced in this contract fully completed on or before the time above specified. THEREFORE, the parties hereto realize in order to adjust satisfactorily the damages on account of such failure that it might be impossible to compute accurately or estimate the amount of such loss or damages which the Owner would sustain by reason of failure to complete fully said work within the time required by this contract. The Contractor hereby covenants and agrees to pay the Owner, as and for **liquidated damages, the sum of $1,000** per day for each and every day, Sunday and legal holidays excepted, during which the work remains incomplete and unfinished. Any sum which may be due the Owner for such damages shall be deducted and retained by the Owner from any balance which may be due the Contractor when said work shall have been finished and accepted. But such provisions shall not release the Bond of the Contractor from liability according to its terms. In case of failure to complete, the Owner will be under no obligation to show or prove any actual or specific loss or damage.

ARTICLE 4. CONTRACT SUM

The Owner shall pay the Contractor for the prompt, faithful and efficient performance of the conditions and undertakings of this contract, subject to additions, and deductions as provided herein, in current funds the sum of:

Base Bid:	$
Alternate No. 1:	$
Alternate No. 2:	$
Alternate No. 3:	$
Alternate No. 4:	$

TOTAL CONTRACT AMOUNT: ($CONTRACT AMOUNT)

UNIT PRICES: The Owner accepts the following Unit Prices: See Attached

For changing specified quantities of work from those indicated by the contract drawings and specifications, upon written instructions of Owner, the following unit prices shall prevail. The unit prices include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, etc., to cover the finished work of the several kinds of work called for. Only a single unit price shall be given and it shall apply for either MORE or LESS work than that shown on the drawings and called for in the specifications or included in the Base Bid. In the event of more or less units than so indicated or included, change orders may be issued for the increased or decreased amount.

ARTICLE 5. PREVAILING WAGE RATE

MISSOURI PREVAILING WAGE LAW (Sections 290.210 to 290.340, RSMo): The Contractor shall pay not less than the specified hourly rate of wages, as set out in the wage order attached to and made part of the specifications for work under this contract, to all workers performing work under the contract, in accordance with sections 290.210 to 290.340, RSMo. The Contractor shall forfeit a penalty to the Owner of one hundred dollars per day (or portion of a day) for each worker that is paid less than the specified rates for any work done under the contract by the Contractor or by any subcontractor, in accordance with section 290.250, RSMo.

ARTICLE 6. MINORITY/WOMEN/SERVICE DISABLED VETERAN BUSINESS ENTERPRISE PARTICIPATION

The Contractor has been granted a waiver of the 10% MBE and 10% WBE and 3% SDVE participation goals. The Contractor agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows: (OR)

The Contractor has met the MBE/WBE/SDVE participation goals and agrees to secure the MBE/WBE/SDVE participation amounts for this project as follows:

MBE/WBE/SDVE Firm: Subcontract Amt:$
MBE/WBE/SDVE Firm: Subcontract Amt:$
MBE/WBE/SDVE Firm: Subcontract Amt:$

Total $

MBE/WBE/SDVE assignments identified above shall not be changed without a contract change signed by the Owner.

The Director of the Division of Facilities Management, Design and Construction or his Designee shall be the final authority to resolve disputes and disagreements between the Contractor and the MBE/WBE/SDVE firms listed above when such disputes impact the subcontract amounts shown above.

ARTICLE 7. CONTRACT DOCUMENTS

The following documents are hereby incorporated into this contract by reference (all division/section numbers and titles are as utilized in the Project Manual published by the Owner for this Project):

1. Division 0 – Procurement and Contracting Information, including, but not limited to:
    a. Invitation for Bid (Section 001116)
    b. Instructions to Bidders (Section 002113)
    c. Supplementary Instructions to Bidders (if applicable) (Section 002213)

d. The following documents as completed and executed by the Contractor and accepted by the Owner, if applicable:
    i. Bid Form (Section 004113)
    ii. Unit Prices (Section 004322)
    iii. Proposed Contractors Form (Section 004336)
    iv. MBE, WBE, SDVE Compliance Evaluation Form(s) (Section 004337)
    v. MBE, WBE, SDVE Eligibility Determination Form for Joint Ventures (Section 004338)
    vi. MBE, WBE, SDVE Good Faith Effort (GFE) Determination Form (Section 004339)
    vii. Missouri Service Disabled Veteran Business Form (Section 004340)
    viii. Affidavit of Work Authorization (Section 004541)
    ix. Affidavit for Affirmative Action (Section 005414)
e. Performance and Payment Bond, completed and executed by the Contractor and surety (Section 006113)
f. General Conditions (Section 007213)
g. Supplementary Conditions (Section 007300)
h. Supplementary General Conditions for Federally Funded/Assisted Construction Projects (Section 007333)
i. Wage Rate(s) (Section 007346)

2. Division 1 – General Requirements
3. All Drawings identified in the Project Manual
4. All Technical Specifications included in the Project Manual
5. Addenda, if applicable

ARTICLE 8 – CERTIFICATION

By signing this contract, the Contractor hereby re-certifies compliance with all legal requirements set forth in Section 6.0, Bidder's Certifications of the Bid Form.

Further, if the Contractor provides any "personal information" as defined in §105.1500, RSMo concerning an entity exempt from federal income tax under Section 501(c) of the Internal Revenue Code of 1986, as amended, the Contractor understands and agrees that it is voluntarily choosing to enter into a state contract and providing such information for that purpose. The state will treat such personal information in accord with §105.1500, RSMo.

By signature below, the parties hereby execute this contract document.

APPROVED:

_____
Brian Yansen, Director
Division of Facilities Management,
Design and Construction

_____
Contractor's Authorized Signature

I, Corporate Secretary, certify that I am Secretary of the corporation named above and that (CONTRACTOR NAME), who signed said contract on behalf of the corporation, was then (TITLE) of said corporation and that said contract was duly signed for and in behalf of the corporation by authority of its governing body, and is within the scope of its corporate powers.

_____
Corporate Secretary

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

AFFIDAVIT FOR AFFIRMATIVE ACTION

PROJECT NUMBER

NAME

First being duly sworn on oath states: that

he/she is the ☐ sole proprietor ☐ partner ☐ officer or ☐ manager or managing member of

NAME

a ☐ sole proprietorship ☐ partnership ☐ limited liability company (LLC)

or ☐ corporation, and as such, said proprietor, partner, or officer is duly authorized to make this affidavit on behalf of said sole proprietorship, partnership, or corporation; that under the contract known as

PROJECT TITLE

Less than 50 persons in the aggregate will be employed and therefore, the applicable Affirmative Action requirements as set forth in Article 1.4 of the General Conditions of the State of Missouri have been met.

PRINT NAME & SIGNATURE	DATE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER SEAL

STATE OF	COUNTY (OR CITY OF ST. LOUIS)
SUBSCRIBED AND SWORN BEFORE ME, THIS DAY OF YEAR	
NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES
NOTARY PUBLIC NAME (TYPED OR PRINTED)	

USE RUBBER STAMP IN CLEAR AREA BELOW

MO 300-1401 (05/18) FILE/Construction Contract

Bond No._____

SECTION 006113 - PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT we _____

as principal, and _____

_____as Surety, are held and firmly bound unto the

STATE OF MISSOURI. in the sum of _____ Dollars ($)

for payment whereof the Principal and Surety bind themselves, their heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

WHEREAS, the Principal has, by means of a written agreement dated the _____

day of_____, 20_____, enter into a contract with the State of Missouri for

_____

_____

_____

(Insert Project Title and Number)

NOW, THEREFORE, if the Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the State of Missouri, with or without notice to the Surety and during the life of any guaranty required under the contract; and shall also faithfully perform and fulfill all undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made with or without notice to the Surety; and shall also promptly make payment for materials incorporated, consumed or used in connection with the work set forth in the contract referred to above, and all insurance premiums, both compensation and all other kinds of insurance, on said work, and for all labor performed on such work, whether by subcontractor or otherwise, at not less than the prevailing hourly rate of wages for work of a similar character (exclusive of maintenance work) in the locality in which the work is performed and not less than the prevailing hourly rate of wages for legal holiday and overtime work (exclusive of maintenance work) in the locality in which the work is performed both as determined by the Department of Labor and Industrial Relations or determined by the Court of Appeal, as provided for in said contract and in any and all duly authorized modifications of said contract that may be hereafter made, with or without notice to the Surety, then, this obligation shall be void and of no effect, but it is expressly understood that if the Principal should make default in or should fail to strictly, faithfully and efficiently do, perform and comply with any or more of the covenants, agreements, stipulations, conditions, requirements or undertakings, as specified in or by the terms of said contract, and with the time therein named, then this obligation shall be valid and binding upon each of the parties hereto and this bond shall remain in full force and effect; and the same may be sued on at the instance of any material man, laborer, mechanic, subcontractor, individual, or otherwise to whom such payment is due, in the name of the State of Missouri, to the use of any such person.

AND, IT IS FURTHER specifically provided that any modifications which may hereinafter be made in the terms of the contract or in the work to be done under it or the giving by the Owner of any extension of the time for the performance of the contract or any other forbearance on the part of either the Owner or the Principal to the other, shall not in any way release the Principal and the Surety, or either or any of them, their heirs, executors, administrators and successors, from their liability hereunder, notice to the Surety of any such extension, modifications or forbearance being hereby waived.

IN WITNESS WHEREOF, the above bounden parties have executed the within instrument this _____ day of _____, 20 ____.

AS APPLICABLE:

AN INDIVIDUAL

Name: _____

Signature: _____

A PARTNERSHIP

Name of Partner: _____

Signature of Partner: _____

Name of Partner: _____

Signature of Partner: _____

CORPORATION

Firm Name: _____

Signature of President: _____

SURETY

Surety Name: _____

Attorney-in-Fact: _____

Address of Attorney-in-Fact: _____

_____

Telephone Number of Attorney-in-Fact: _____

Signature Attorney-in-Fact: _____

NOTE: Surety shall attach Power of Attorney

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

PRODUCT SUBSTITUTION REQUEST

PROJECT NUMBER

PROJECT TITLE AND LOCATION

CHECK APPROPRIATE BOX

☐ SUBSTITUTION PRIOR TO BID OPENING
(Minimum of (5) working days prior to receipt of Bids as per Article 4 – Instructions to Bidders)

☐ SUBSTITUTION FOLLOWING AWARD
(Maximum of (20) working days from Notice to Proceed as per Article 3 – General Conditions)

FROM: BIDDER/CONTRACTOR (PRINT COMPANY NAME)

TO: ARCHITECT/ENGINEER (PRINT COMPANY NAME)

Bidder/Contractor hereby requests acceptance of the following product or systems as a substitution in accordance with provisions of Division One of the Bidding Documents:

SPECIFIED PRODUCT OR SYSTEM

SPECIFICATION SECTION NO.

SUPPORTING DATA

☐ Product data for proposed substitution is attached (include description of product, standards, performance, and test data)

☐ Sample ☐ Sample will be sent, if requested

QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION REQUEST
NAME, BRAND		
CATALOG NO.		
MANUFACTURER		
VENDOR		

PREVIOUS INSTALLATIONS

PROJECT	ARCHITECT/ENGINEER	
LOCATION		DATE INSTALLED

SIGNIFICANT VARIATIONS FROM SPECIFIED PRODUCT

REASON FOR SUBSTITUTION

DOES PROPOSED SUBSTITUTION AFFECT OTHER PARTS OF WORK?

☐ YES ☐ NO

IF YES, EXPLAIN

SUBSTITUTION REQUIRES DIMENSIONAL REVISION OR REDESIGN OF STRUCTURE OR A/E WORK

☐ YES ☐ NO

BIDDER'S/CONTRACTOR'S STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT:

We have investigated the proposed substitution. We believe that it is equal or superior in all respects to specified product, except as stated above; that it will provide the same Warranty as specified product; that we have included complete implications of the substitution; that we will pay redesign and other costs caused by the substitution which subsequently become apparent; and that we will pay costs to modify other parts of the Work as may be needed, to make all parts of the Work complete and functioning as a result of the substitution.

BIDDER/CONTRACTOR	DATE

REVIEW AND ACTION

☐ Resubmit Substitution Request with the following additional information:

☐ Substitution is accepted.

☐ Substitution is accepted with the following comments:

☐ Substitution is not accepted.

ARCHITECT/ENGINEER	DATE

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

FINAL RECEIPT OF PAYMENT AND RELEASE

PROJECT NUMBER

KNOW ALL MEN BY THESE PRESENT THAT: hereinafter called "Subcontractor" who heretofore entered into an agreement with hereinafter called "Contractor", for the performance of work and/or furnishing of material for the construction of the project entitled

(PROJECT TITLE, PROJECT LOCATION, AND PROJECT NUMBER)

at

(ADDRESS OF PROJECT)

for the State of Missouri (Owner) which said subcontract is by this reference incorporated herein, in consideration of such final payment by Contractor.

DOES HEREBY:

1. ACKNOWLEDGE that they have been **PAID IN FULL** all sums due for work and materials contracted or done by their Subcontractors, Material Vendors, Equipment and Fixture Suppliers, Agents and Employees, or otherwise in the performance of the Work called for by the aforesaid Contract and all modifications or extras or additions thereto, for the construction of said project or otherwise.
2. RELEASE and fully, finally, and forever discharge the Owner from any and all suits, actions, claims, and demands for payment for work performed or materials supplied by Subcontractor in accordance with the requirements of the above referenced Contract.
1. REPRESENT that all of their Employees, Subcontractors, Material Vendors, Equipment and Fixture Suppliers, and everyone else has been **paid in full** all sums due them, or any of them, in connection with performance of said Work, or anything done or omitted by them, or any of them in connection with the construction of said improvements, or otherwise.

DATED this day of , 20 .

NAME OF SUBCONTRACTOR

BY (TYPED OR PRINTED NAME)

SIGNATURE

TITLE

ORIGINAL: FILE/Closeout Documents

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION

PAY APP NO.	PROJECT NUMBER
CHECK IF FINAL ☐**FINAL**	DATE

MBE/WBE/SDVE PROGRESS REPORT

Remit with **ALL** Progress and Final Payments

(Please check appropriate box) ☐CONSULTANT ☐CONSTRUCTION

PROJECT TITLE	
PROJECT LOCATION	
FIRM	
ORIGINAL CONTRACT SUM (Same as Line Item 1. on Form A of Application for Payment) **$**	TOTAL CONTRACT SUM TO DATE (Same as Line Item 3. on Form A of Application for Payment) **$**

THE TOTAL MBE/WBE/SDVE PARTICIPATION DOLLAR AMOUNT OF THIS PROJECT AS INDICATED IN THE ORIGINAL CONTRACT: **$**

SELECT MBE, WBE, SDVE	ORIGINAL CONTRACT PARTICIPATION AMOUNT	PARTICIPATION AMOUNT PAID-TO-DATE (includes approved contract changes)	CONSULTANT/SUBCONSULTANT OR CONTRACTOR/SUBCONTRACTOR/SUPPLIER COMPANY NAME
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	
☐ MBE ☐ WBE ☐ SDVE	$	$	

Revised 05/21

INSTRUCTIONS FOR MBE/WBE/SDVE PROGRESS REPORT

CONTRACTOR OR CONSULTANT TO FILL OUT AND REMIT WITH EACH PAY APPLICATION:

The MBE/WBE/SDVE Progress Report for the project is issued with the contract comprising values reported in the consultant's Proposal or on the successful contractor's Section 004337 Compliance Evaluation Forms.

At Initial Pay Application fill in the following:

1. Pay App No. Start with 1.
2. Fill in the Project Number and Date.
3. Enter Project Title, Project Location, and Firm.
4. Fill in the "Original Contract Sum" and "Total Contract Sum To Date" (Reference applicable Line Items on Form A of Application for Payment).
5. Indicate the Total Participation Dollar Amount from the Original Contract.
6. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier.
7. Enter the "Total Amount of Subcontract", "$ Amount (Paid-To-Date)", and Company Name.

For all subsequent Pay Applications fill in the following:

1. Pay App No.
2. If Final Pay App, check box.
3. Fill in the Project Number and Date.
4. Enter Project Title, Project Location, and Firm
5. At each Pay App fill in the "Original Contract Sum" and "Total Contract Sum To Date" (reference applicable Line Items on Form A of Application for Payment).
6. Indicate the Total Participation Dollar Amount from the Original Contract.
7. Select MBE, WBE, or SDVE for each Consultant/Subconsultant or Contractor/Subcontractor/Supplier
8. Enter the "Total Amount of Subcontract", "$ Amount (Paid-To-Date)", and Company Name.

STATE OF MISSOURI
OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION
AFFIDAVIT – COMPLIANCE WITH PREVAILING WAGE LAW

PROJECT NUMBER

Before me, the undersigned Notary Public, in and for the County of _____

State of _____ personally came and appeared _____
(NAME)

_____ of the _____
(POSITION) (NAME OF THE COMPANY)

(a corporation) (a partnership) (a proprietorship) and after being duly sworn did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works project have been fully satisfied and there has been no exception to the full and completed compliance with said provisions and requirements and with Wage Determination No: _____ issued by the Department of Labor and Industrial Relations, State of Missouri on the _____ day of _____ 20 __ in carrying out the contract and working in connection with _____
(NAME OF PROJECT)

Located at _____ in _____ County
(NAME OF THE INSTITUTION)

Missouri, and completed on the _____ day of _____ 20 __

SIGNATURE

NOTARY INFORMATION

NOTARY PUBLIC EMBOSSER OR BLACK INK RUBBER STAMP SEAL	STATE		COUNTY (OR CITY OF ST. LOUIS)
	SUBSCRIBED AND SWORN BEFORE ME, THIS DAY OF YEAR		**USE RUBBER STAMP IN CLEAR AREA BELOW**
	NOTARY PUBLIC SIGNATURE	MY COMMISSION EXPIRES	
	NOTARY PUBLIC NAME (TYPED OR PRINTED)		

FILE: Closeout Documents

GENERAL CONDITIONS

INDEX

SECTION 007213 - GENERAL CONDITIONS

A. These General Conditions apply to each section of these specifications. The Contractor is subject to the provisions contained herein.

B. The General Conditions are intended to define the relationship of the Owner, the Designer and the Contractor thereby establishing certain rules and provisions governing the operation and performance of the work so that the work may be performed in a safe, orderly, expeditious and workmanlike manner.

ARTICLE 1 – GENERAL PROVISIONS

ARTICLE 1.1 - DEFINITIONS

As used in these contract documents, the following terms shall have the meanings and refer to the parties designated in these definitions.

1. **"COMMISSIONER":** The Commissioner of the Office of Administration.
2. **"CONSTRUCTION DOCUMENTS":** The "Construction Documents" shall consist of the Project Manual, Drawings and Addenda.
3. **"CONSTRUCTION REPRESENTATIVE:"** Whenever the term "Construction Representative" is used, it shall mean the Owner's Representative at the work site.
4. **"CONTRACTOR"**: Party or parties who have entered into a contract with the Owner to furnish work under these specifications and drawings.
5. **"DESIGNER"**: When the term "Designer" is used herein, it shall refer to the Architect, Engineer, or Consultant of Record specified and defined in Paragraph 2.0 of the Supplemental Conditions, or his duly authorized representative. The Designer may be either a consultant or state employee.
6. **"DIRECTOR"**: Whenever the term "Director" is used, it shall mean the Director of the Division of Facilities Management, Design and Construction or his Designee, representing the Office of Administration, State of Missouri. The Director is the agent of the Owner.
7. **"DIVISION":** Shall mean the Division of Facilities Management, Design and Construction, State of Missouri.
8. **"INCIDENTAL JOB BURDENS":** Shall mean those expenses relating to the cost of work, incurred either in the home office or on the job-site, which are necessary in the course of doing business but are incidental to the job. Such costs include office supplies and equipment, postage, courier services, telephone expenses including long distance, water and ice and other similar expenses.
9. **"JOINT VENTURE"**: An association of two (2) or more businesses to carry out a single business enterprise for profit for which purpose they combine their property, capital, efforts, skills and knowledge.
10. **"OWNER"**: Whenever the term "Owner" is used, it shall mean the State of Missouri, acting by and through the Office of Administration, Division of Facilities Management, Design and Construction.
11. **"PROJECT"**: Wherever the term "Project" is used, it shall mean the work required to be completed by the construction contract.
12. **"PROJECT MANUAL"**: The "Project Manual" shall consist of Introductory Information, Invitation for Bid, Instructions to Bidders, Bid Documents, Additional Information, Standard Forms, General Conditions, Supplemental General Conditions, General Requirements and Technical Specifications.
13. **"SUBCONTRACTOR"**: Party or parties who contract under, or for the performance of part or this entire Contract between the Owner and Contractor. The subcontract may or may not be direct with the Contractor.
14. **"WORK"**: All supervision, labor, materials, tool, supplies, equipment, and any incidental operations and/or activities required by or reasonably inferable from the Contract Documents necessary to construct the Project and to produce the results intended by the Contract Documents in a safe, expeditious, orderly, and workmanlike manner, and in the best manner known to each respective trade.
15. "**WORKING DAYS**": are all calendar days except Saturdays, Sundays and the following holidays: New Year's Day, Martin Luther King, Jr. Day, Lincoln Day, Washington's Birthday (observed), Truman Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Columbus Day, Veterans Day (observed), Thanksgiving Day, Christmas Day.

ARTICLE 1.2 DRAWINGS AND SPECIFICATIONS

A. In case of discrepancy between drawings and specifications, specifications shall govern. Should discrepancies in architectural drawings, structural drawings and mechanical drawings occur, architectural drawings shall govern and, in case of conflict between structural and mechanical drawings, structural drawings shall govern.

B. Specifications are separated into titled divisions for convenience of reference only and to facilitate letting of contracts and subcontracts. The Contractor is responsible for establishing the scope of work for subcontractors, which may cross titled divisions. Neither the Owner nor Designer will establish limits and jurisdiction of subcontracts.

C. Figured dimensions take precedence over scaled measurements and details over smaller scale general drawings. In the event of conflict between any of the documents contained within the contract, the documents shall take precedence and be controlling in the following sequence: addenda, supplementary general conditions, general conditions, division 1 specifications, technical division specifications, drawings, bid form and instructions to bidders.

D. Anything shown on drawings and not mentioned in these specifications or vice versa, as well as any incidental work which is obviously necessary to complete the project within the limits established by the drawings and specifications, although not shown on or described therein, shall be performed by the Contractor at no additional cost as a part of his contract.

E. Upon encountering conditions differing materially from those indicated in the contract documents, the Contractor shall promptly notify the Designer and Construction Representative in writing before such conditions are disturbed. The Designer shall promptly investigate said conditions and report to the Owner, with a recommended course of action**.** If conditions do materially differ and cause an increase or decrease in contract cost or time required for completion of any portion of the work, a contract change will be initiated as outlined in Article 4 of these General Conditions.

E. Only work included in the contract documents is authorized, and the Contractor shall do no work other than that described therein or in accordance with appropriately authorized and approved contract changes.

ARTICLE 1.3 - COMPLIANCE WITH LAWS, PERMITS, REGULATIONS AND INSPECTIONS

A. Since the Owner is the State of Missouri, municipal or political subdivisions, zoning ordinances, construction codes (other than licensing of trades), and other like ordinances are not applicable to construction on Owner's property, and Contractor will not be required to submit drawings and specifications to any municipal or political subdivision, authority, obtain construction permits or any other licenses (other than licensing of trades) or permits from or submit to inspections by any municipality or political subdivision relating to the construction for this project. All permits or licenses required by municipality or political subdivision for operation on property not belonging to Owner shall be obtained by and paid for by Contractor. Each Contractor shall comply with all applicable laws, ordinances, rules and regulations that pertain to the work of this contract.

B. Contractors, subcontractors and their employees engaged in the businesses of electrical, mechanical, plumbing, carpentry, sprinkler system work, and other construction related trades shall be licensed to perform such work by the municipal or political subdivision where the project is located, if such licensure is required by local code. Local codes shall dictate the level (master, journeyman, and apprentice) and the number, type and ratio of licensed tradesmen required for this project within the jurisdiction of such municipal or political subdivision.

C. Equipment and controls manufacturers and their authorized service and installation technicians that do not maintain an office within the jurisdiction of the municipal or political subdivision but are a listed or specified contractor or subcontractor on this project are exempt from Paragraph 1.3 B above.

D. The Contractor shall post a copy of the wage determination issued for the project and included as a part of the contract documents, in a prominent and easily accessible location at the site of construction for the duration of the project.

E. Any contractor or subcontractor to such contractor at any tier signing a contract to work on this project shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. The contractor shall

forfeit as a penalty to the public body on whose behalf the contract is made or awarded, two thousand five hundred dollars plus one hundred dollars for each employee employed by the contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training.

ARTICLE 1.4 - NONDISCRIMINATION IN EMPLOYMENT

A. The Contractor and his subcontractors will not discriminate against individuals based on race, color, religion, national origin, sex, disability, or age, but may use restrictions which relate to bona fide occupational qualifications. Specifically, the Contractor and his subcontractors shall not discriminate:

1. Against recipients of service on the basis of race, color, religion, national origin, sex, disability or age.

2. Against any employee or applicant, for employment on the basis of race, color, religion, national origin, sex or otherwise qualified disability status.

3. Against any applicant for employment or employee on the basis of age, where such applicant or employee is between ages 40 and 70 and where such Contractor employs at least 20 persons.

4. Against any applicant for employment or employee on the basis of that person's status as a disabled or Vietnam-era veteran.

The Contractor and his Subcontractors will take affirmative action to insure applicants for employment and employees are treated equally without regard to race, color, religion, national origin, sex, disability, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion and transfer; recruitment or recruitment advertising; and selection for training, including apprenticeship. The Contractor and his Subcontractors will give written notice of their commitments under this clause to any labor union with which they have bargaining or other agreements.

B. The Contractor and his subcontractors shall develop, implement, maintain and submit in writing to the Owner an affirmative action program if at least fifty (50) persons in the aggregate are employed under this contract. If less than fifty (50) persons in the aggregate are to be employed under this contract, the Contractor shall submit, in lieu of the written affirmative action program, a properly executed Affidavit for Affirmative Action in the form included in the contract specifications. For the purpose of this section, an "affirmative action program" means positive action to influence all employment practices (including, but not limited to, recruiting, hiring, promoting and training) in providing equal employment opportunity regardless of race, color, sex, national origin, religion, age (where the person affected is between age 40 and 70), disabled and Vietnam-era veteran status, and disability. Such "affirmative action program" shall include:

1. A written policy statement committing the total organization to affirmative action and assigning management responsibilities and procedures for evaluation and dissemination;

2. The identification of a person designated to handle affirmative action;

3. The establishment of non-discriminatory selection standards, objective measures to analyze recruitment, an upward mobility system, a wage and salary structure, and standards applicable to lay-off, recall, discharge, demotion and discipline;

4. The exclusion of discrimination from all collective bargaining agreements; and

5. Performance of an internal audit of the reporting system to monitor execution and to provide for future planning.

In the enforcement of this non-discrimination clause, the Owner may use any reasonable procedures available, including, but not limited to: requests, reports, site visits and inspection of relevant documents of contractors and subcontractors.

C. In the event of the Contractor's or his subcontractor's noncompliance with any provisions of this Article of the Contract, the Owner may cancel this contract in whole or in part or require the Contractor to terminate his contract with the subcontractor.

ARTICLE 1.5 - ANTI-KICKBACK

No employee of the division, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract or in any part hereof. No officer, employee, designer, attorney, or administrator of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall have or acquire any pecuniary interest, whether direct or indirect, in this contract, any material supply contract, subcontract,

insurance contract, or any other contract pertaining to the project.

ARTICLE 1.6 - PATENTS AND ROYALTIES

A. The Contractor shall hold and save the Owner and its officers, agents, servants and employees harmless from liabilities of any nature or kind, including cost and expenses, for, or on account of, any patented or unpatented invention, process, article or appliance manufactured or used in the performance of this contract, including its use by the Owner, unless otherwise specifically stipulated in the contract documents.

B. If the Contractor uses any design, device or materials covered by letters, patent or copyright, the Contractor shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, without exception, that the contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the Owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract and shall indemnify the Owner for any cost, expense or damage it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

ARTICLE 1.7 - PREFERENCE FOR AMERICAN AND MISSOURI PRODUCTS AND SERVICES

A. By virtue of statutory authority a preference will be given to Missouri labor and to products of mines, forests and quarries of the state of Missouri when they are found in marketable quantities in the state, and all such materials shall be of the best quality and suitable character that can be obtained at reasonable market prices, all as provided for in Section 8.280, Missouri Revised Statutes and Cumulative Supplements.

B. Furthermore, pursuant to Section 34.076 Missouri Revised Statutes and Cumulative Supplements, a preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the non-domiciliary state.

C In accordance with the Missouri Domestic Products Procurement Act Section 34.350 RSMo and Cumulative Supplements any manufactured goods or commodities used or supplied in the performance of this contract or any subcontract thereto shall be manufactured, assembled or produced in the United States, unless the specified products are not manufactured, assembled or produced in the United States in sufficient quantities to meet the agency's requirements or cannot be manufactured, assembled or produced in the United States within the necessary time in sufficient quantities to meet the contract requirements, or if obtaining the specified products manufactured, assembled or produced in the United States would increase the cost of this contract for purchase of the product by more than ten percent.

ARTICLE 1.8 - COMMUNICATIONS

A. All notices, requests, instructions, approvals and claims must be in writing and shall be delivered to the Designer and copied to the Construction Representative for the project except as required by Article 1.12 Disputes and Disagreements, or as otherwise specified by the Owner in writing as stated in Section 012600. Any such notice shall be deemed to have been given as of the time of actual receipt.

B. The Contractor shall attend on-site progress and coordination meetings, as scheduled by the Construction Representative, no less than once a month.

C. The Contractor shall ensure that major subcontractors and suppliers shall attend monthly progress meetings as necessary to coordinate the work, and as specifically requested by the Construction Representative.

ARTICLE 1.9 - SEPARATE CONTRACTS AND COOPERATION

A. The Owner reserves the right to let other contracts in connection with this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and coordinate his work with theirs.

B. The Contractor shall consult the drawings for all other contractors in connection with this work. Any work conflicting with the above shall be brought to the attention of the Owner’s Representative before the work is performed. If the Contractor fails to do this, and constructs any

work which interferes with the work of another contractor, the Contractor shall remove any part so conflicting and rebuild same, as directed by the Owner's Representative at no additional cost to the Owner.

C. Each contractor shall be required to coordinate his work with other contractors so as to afford others reasonable opportunity for execution of their work. No contractor shall delay any other contractor by neglecting to perform contract work at the proper time. If any contractor causes delay to another, they shall be liable directly to that contractor for such delay in addition to any liquidated damages which might be due the Owner.

D. Should the Contractor or project associated subcontractors refuse to cooperate with the instructions and reasonable requests of other Contractors or other subcontractors in the overall coordinating of the work, the Owner may take such appropriate action and issue directions, as required, to avoid unnecessary and unwarranted delays.

E. Each Contractor shall be responsible for damage done to Owner's or other Contractor's property by him/her or workers in his employ through their fault or negligence.

F. Should a Contractor sustain any damage through any act or omission of any other Contractor having a contract with the Owner, the Contractor so damaged shall have no claim or cause of action against the Owner for such damage, but shall have a claim or cause of action against the other Contractor to recover any and all damages sustained by reason of the acts or omissions of such Contractor. The phrase "acts or omissions" as used in this section shall be defined to include, but not be limited to, any unreasonable delay on the part of any such contractors.

ARTICLE 1.10 - ASSIGNMENT OF CONTRACT

A. No assignment by Contractor of any amount or any part of this contract or of the funds to be received there under will be recognized unless such assignment has had the written approval of the Director and the surety has been given due notice of such assignment and has furnished written consent thereto. In addition to the usual recitals in assignment contracts, the following language must be set forth: "It is agreed that the funds to be paid to the assignee under this assignment are subject to performance by the Contractor of this contract and to claims or liens for services rendered or materials supplied for the performance of the work called for in said contract in favor of all persons, firms or corporations rendering such services or supplying such materials."

ARTICLE 1.11 - INDEMNIFICATION

A. Contractor agrees to indemnify and save harmless Owner and its respective commissioners, officers, officials, agents, consultants and employees and Designer, their agents, servants and employees, from and against any and all liability for damage arising from injuries to persons or damage to property occasioned by any acts or omissions of Contractor, any subcontractors, agents, servants or employees, including any and all expense, legal or otherwise, which may be incurred by Owner or Designer, its agents, servants or employees, in defense of any claim, action or suit.

B. The obligations of the Contractor under this paragraph shall not extend to the liability of the Designer, his agents or employees, arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, contract changes, design or specifications, or (2) giving of or the failure to give directions or instructions by the Designer, his agents or employees as required by this contract documents provided such giving or failure to give is the primary cause of the injury or damage.

ARTICLE 1.12 - DISPUTES AND DISAGREEMENTS

It is hereby expressly agreed and understood that in case any controversy or difference of opinion arises during construction, best efforts will be given to resolution at the field level. Should those efforts be unsuccessful, the Contractor has the right to appeal in writing, the decision of the Director's Designee to the Director at Room 730 Truman Building, P.O. Box 809, Jefferson City, Missouri 65102. The decision of the Director shall be final and binding on all parties.

ARTICLE 2 -- OWNER/DESIGNER RESPONSIBILITIES

A. The Owner shall give all orders and directions contemplated under this contract relative to the execution of the work. During progress of work the Owner will be represented at the project site by the Construction Representative and/or Designer, whose responsibilities are to see that this contract is properly fulfilled.

B. The Owner shall at all times have access to the work whenever it is in preparation or progress. The Contractors shall provide proper facilities for such access and for inspection and supervision.

C. All materials and workmanship used in the work shall be subject to the inspection of the Designer and Construction Representative, and any work which is deemed defective shall be removed, rebuilt or made good immediately upon notice.

The cost of such correction shall be borne by the Contractor. Contractor shall not be entitled to an extension of the contract completion date in order to remedy defective work. All rejected materials shall be immediately removed from the site of the work.

D. If the Contractor fails to proceed at once with the correction of rejected defective materials or workmanship, the Owner may, by separate contract or otherwise, have the defects remedied or rejected. Materials removed from the site and charge the cost of the same against any monies which may be due the Contractor, without prejudice to any other rights or remedies of the Owner.

E. Failure or neglect on the part of Owner to observe faulty work, or work done which is not in accordance with the drawings and specifications shall not relieve the Contractor from responsibility for correcting such work without additional compensation.

F. The Owner shall have the right to direct the Contractor to uncover any completed work.

1. If the Contractor fails to adequately notify the Construction Representative and/or Designer of an inspection as required by the Contract Documents, the Contractor shall, upon written request, uncover the work. The Contractor shall bear all costs associated with uncovering and again covering the work exposed.

2. If the Contractor is directed to uncover work, which was not otherwise required by the Contract Documents to be inspected, and the work is found to be defective in any respect, no compensation shall be allowed for this work. If, however, such work is found to meet the requirements of this contract, the actual cost of labor and material necessarily involved in the examination and replacement plus 10% shall be allowed the Contractor.

G. The Designer shall give all orders and directions contemplated under this contract relative to the scope of the work and shall give the initial interpretation of the contract documents.

H. The Owner may file a written notice to the Contractor to dismiss immediately any subcontractors, project managers, superintendents, foremen, workers, watchmen or other employees whom the Owner may deem incompetent, careless or a hindrance to proper or timely execution of the work. The Contractor shall comply with such notice as promptly as practicable without detriment to the work or its progress.

I. If in the Owner's judgment it becomes necessary at any time to accelerate work, when ordered by the Owner in writing, the Contractor shall redirect resources to such work items and execute such portions of the work as may be required to complete the work within the current approved contract schedule.

ARTICLE 3 -- CONTRACTOR RESPONSIBILITIES

The Contractor shall register and utilize the Owner's eBuilder digital project management system for submission of documents described in the following sections. This includes but is not limited to submittals as required by designer, payment applications, Request for Information (RFI), construction change orders, Request for Proposals (RFP), Designer Supplemental Instructions (DSI), etc.

ARTICLE 3.1 -- ACCEPTABLE SUBSTITUTIONS

A. The Contractor may request use of any article, device, product, material, fixture, form or type of construction which in the judgment of the Owner and Designer is equal in all respects to that named. Standard products of manufacturers other than those specified will be accepted when, prior to the ordering or use thereof, it is proven to the satisfaction of the Owner and Designer that they are equal in design, strength, durability, usefulness and convenience for the purpose intended.

B. Any changes required in the details and dimensions indicated on the drawings for the substitution of products other than those specified shall be properly made at the expense of the Contractor requesting the substitution or change.

C. The Contractor shall submit a request for such substitutions in writing to the Owner and Designer within twenty (20) working days after the date of the "Notice to Proceed." Thereafter no consideration will be given to alternate forms of accomplishing the work. This Article does not preclude the Owner from exercising the provisions of Article 4 hereof.

D. Any request for substitution by the Contractor shall be submitted in accordance with SECTION 002113 - INSTRUCTIONS TO BIDDERS.

E. When a material has been approved, no change in brand or make will be permitted unless:

1. Written verification is received from the manufacturer stating they cannot make delivery on the date previously agreed, or

2. Material delivered fails to comply with contract requirements.

ARTICLE 3.2 -- SUBMITTALS

A. The Contractor's submittals must be submitted with such promptness as to allow for review and approval so as not to cause delay in the work. The Contractor shall coordinate preparation and processing of submittals with performance of construction activities.

   Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

   Submit four (4) copies to the Designer and additional copies as required for the subcontractors and material suppliers. Also provide copies to meet the requirements for maintenance manuals.

B. All subcontractors' shop drawings and schedules shall be submitted by the Contractor and shall bear evidence that Contractor has received, reviewed, and approved them. Any shop drawings and schedules submitted without this evidence will be returned to the Contractor for resubmission.

C. The Contractor shall include with the shop drawing, a letter indicating any and all deviations from the drawings and/or specifications. Failure to notify the Designer of such deviations will be grounds for subsequent rejection of the related work or materials. If, in the opinion of the Designer, the deviations are not acceptable, the Contractor will be required to furnish the item as specified and indicated on the drawings.

D. The Designer shall check shop drawings and schedules with reasonable promptness and approve them only if they conform to the design concept of the project and comply with the information given in the contract documents. The approval shall not relieve the Contractor from the responsibility to comply with the drawings and specifications, unless the Contractor has called the Designer's attention to the deviation, in writing, at the time of submission and the Designer has knowingly approved thereof. An approval of any such modification will be given only under the following conditions:

   1. It is in the best interest of the Owner
   2. It does not increase the contract sum and/or completion time
   3. It does not deviate from the design intent
   4. It is without prejudice to any and all rights under the surety bond.

E. No extension of time will be granted because of the Contractor's failure to submit shop drawings and schedules in ample time to allow for review, possible resubmission, and approval. Fabrication of work shall not commence until the Contractor has received approval. The Contractor shall furnish prints of approved shop drawings and schedules to all subcontractors whose work is in any way related to the work under this contract. Only prints bearing this approval will be allowed on the site of construction

F. The Contractor shall maintain a complete file on-site of approved shop drawings available for use by the Construction Representative.

ARTICLE 3.3 – AS-BUILT DRAWINGS

A. The Contractor shall update a complete set of the construction drawings, shop drawings and schedules of all work monthly by marking changes, and at the completion of their work (prior to submission of request for final payment) note all changes and turn the set over to the Construction Representative. The updates shall show all addenda, all field changes that were made to adapt to field conditions, changes resulting from contract changes or supplemental instructions, and all locations of structures, buried installations of piping, conduit, and utility services. All buried and concealed items both inside and outside shall be accurately located as to depth and referenced to permanent features such as interior or exterior wall faces and dimensions shall be given in a neat and legible manner in a contrasting colored pencil or ink. If approved by the Designer, an electronic file format may be provided.

ARTICLE 3.4 – GUARANTY AND WARRANTIES

A. General Guaranty

   1. Neither the final certificate of payment nor any provision in the contract documents nor partial use or occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with contract requirements.
   2. The Contractor or surety shall remedy any defects in the work and pay for any damage to property resulting there from which shall appear within a period of one (1) year from the date of substantial completion unless a longer period is otherwise specified or a differing guaranty period has been established in the substantial completion certificate. The Owner will give notice of observed defects with reasonable promptness.
   3. In case of default on the part of the Contractor in fulfilling this part of this contract, the Owner may correct the work or repair the

damage and the cost and expense incurred in such event shall be paid by or recoverable from the Contractor or surety.

4. The work will be free from defects not inherent in the quality required or permitted, and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment

B. Extended Warranty

Manufacturer's certificates of warranty shall be obtained for all major equipment. Warranty shall be obtained for at least one year. Where a longer period is offered at no additional cost or called for in the specific equipment specifications, the longer period shall govern.

ARTICLE 3.5 -- OPERATION AND MAINTENANCE MANUALS

A. Immediately after equipment submittals are approved and no later than ten (10) working days prior to the substantial completion inspection, the Contractor shall provide to the Designer three (3) copies of operating instructions and service manuals, containing the following:

1. Start-up and Shut-down Procedures: Provide a step-by-step write up of all major equipment. When manufacturer's printed start-up, trouble shooting and shut-down procedures are available; they may be incorporated into the operating manual for reference.

2. Operating Instructions: Written operating instructions shall be included for the efficient and safe operation of all equipment.

3. Equipment List: List of all major equipment as installed shall be prepared to include model number, capacities, flow rate, name place data, shop drawings and air and water balance reports.

4. Service Instructions: Provide the following information for all pieces of equipment.

   a. Recommended spare parts including catalog number and name of local supplier or factory representative.

   b. Belt sizes, types, and lengths.

   c. Wiring diagrams.

5. Manufacturer's Certificate of Warranty as described in Article 3.4.

6. Prior to the final payment, furnish to the Designer three (4) copies of parts catalogs for each piece of equipment furnished by him/her on the project with the components identified by number for replacement ordering.

B. Submission of operating instructions shall be done in the following manner.

1. Manuals shall be in quadruplicate, and all materials shall be bound into volumes of standard 8½" x 11" hard binders. Large drawings too bulky to be folded into 8½" x 11" shall be separately bound or folded and in envelopes, cross referenced and indexed with the manuals.

2. The manuals shall identify project name, project number, and include the name and address of the Contractor, subcontractors and manufacturers who were involved with the activity described in that particular manual.

3. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titles clearly printed under reinforced laminated plastic tabs.

4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified.

ARTICLE 3.6 – OTHER CONTRACTOR RESPONSIBILITIES

A. The Contractor shall keep on site, during progress of the work, a competent superintendent satisfactory to the Construction Representative. The superintendent shall represent the Contractor and all agreements made by the superintendent shall be binding. The superintendent shall carefully study and compare all drawings, specifications and other instructions and shall promptly notify the Construction Representative and Designer, in writing, any error, inconsistency or omission which may be discovered. The superintendent shall coordinate all work on the project. Any change of the superintendent shall be approved by the Construction Representative.

B. Contractor shall, at all times, enforce strict discipline and good order among his employees,

and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him/her.

C. The Contractor shall supply sufficient labor, material, plant and equipment and pay when due any laborer, subcontractor or supplier for supplies furnished and otherwise prosecute the work with diligence to prevent work stoppage and insure completion thereof within the time specified.

D. The Contractor and each of his subcontractors shall submit to the Construction Representative, through the Designer such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as the Owner may request concerning work performed or to be performed under this contract.

E. The Contractor, subcontractors, and material suppliers shall upon written request, give the Owner access to all time cards, material invoices, payrolls, estimates, profit and loss statements, and all other direct or indirect costs related to this work.

F. The Contractor shall be responsible for laying out all contract work such as layout of architectural, structural, mechanical and electrical work, which shall be coordinated with layouts of subcontractors for general construction work. The Contractor is also responsible for unloading, uncrating and handling of all materials and equipment to be erected or placed by him/her, whether furnished by Contractor or others. No extra charges or compensation will be allowed as a result of failure to verify dimensions before ordering materials or fabricating items.

G. The Contractor must notify the Construction Representative at least one working day before placing concrete or burying underground utilities, pipelines, etc.

H. Contractors shall prearrange time with the Construction Representative for the interruption of any facility operation. Unless otherwise specified in these documents, all connections, alterations or relocations as well as all other portions of the work will be performed during normal working hours.

I. The Contractor shall coordinate all work so there will not be prolonged interruptions of existing equipment operation. Any existing plumbing, heating, ventilating, air conditioning or electrical disconnections necessary for the project, which affect portions of this construction or building or any other building must be scheduled with the Construction Representative to minimize or avoid any disruption of facility operations. In no case, unless previously approved in writing by the Construction Representative, shall utilities be left disconnected at the end of a work day or over a weekend. Any interruption of utilities either intentionally or accidentally shall not relieve the Contractor responsible for the interruption from the responsibility to repair and restore the utility to normal service. Repairs and restoration shall be made before the workers responsible for the repair and restoration leave the job.

J. Contractors shall limit operations and storage of materials to the area within the project, except as necessary to connect to existing utilities, and shall not encroach on neighboring property. The Contractor shall be responsible for repair of their damage to property on or off the project site occurring during construction of project. All such repairs shall be made to the satisfaction of the property owner.

K. Unless otherwise permitted, all materials shall be new and both workmanship and materials shall be of the best quality.

L. Unless otherwise provided and stipulated within these specifications, the Contractor shall furnish, construct, and/or install and pay for materials, devices, mechanisms, equipment, all necessary personnel, utilities including, but not limited to water, heat, light and electric power, transportation services, applicable taxes of every nature, and all other facilities necessary for the proper execution and completion of the work.

M. Contractor shall carefully examine the plans and drawings and shall be responsible for the proper fitting of his material, equipment and apparatus into the building.

N. The Contractor or subcontractors shall not overload, or permit others to overload, any part of any structure during the performance of this contract.

O. All temporary shoring, bracing, etc., required for the removal of existing work and/or for the installation of new work shall be included in this contract. The Contractor shall make good, at no cost to the Owner, any damage caused by improper support or failure of shoring in any respect. Each Contractor shall be responsible for shoring required to protect his work or adjacent property and improvements of Owner and shall be responsible for shoring or for giving written notice to adjacent property owners. Shoring shall be removed only after completion of permanent supports.

P. The Contractor shall provide at the proper time such material as is required for support of the work. If openings are required, whether shown on drawings or not, the Contractor shall see that they are properly constructed.

Q. During the performance of work the Contractor shall be responsible for providing and maintaining warning signs, lights, signal devices, barricades, guard rails, fences and other devices appropriately located on site which will give proper and understandable warning to all persons of danger of entry onto land, structure or equipment.

R. The Contractor shall be responsible for protection, including weather protection, and proper maintenance of all equipment and materials.

S. The Contractor shall be responsible for care of the finished work and shall protect same from damage or defacement until substantial completion by the Owner. If the work is damaged by any cause, the Contractor shall immediately begin to make repairs in accordance with the drawings and specifications. Contractor shall be liable for all damage or loss unless attributable to the acts or omissions of the Owner or Designer. Any claim for reimbursement shall be submitted in accordance with Article 4. After substantial completion the Contractor will only be responsible for damage resulting from acts or omissions of the Contractor or subcontractors through final warranty.

T. In the event the Contractor encounters an unforeseen hazardous material, the Contractor shall immediately stop work in the area affected and report the condition to the Owner and Designer in writing. The Contractor shall not be required, pursuant to Article 4, to perform, any work relating to hazardous materials.

U. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 4.

V. Before commencing work, Contractors shall confer with the Construction Representative and facility representative and review any facility rules and regulations which may affect the conduct of the work.

W. Project signs will only be erected on major projects and only as described in the specifications. If no sign is specified, none shall be erected.

ARTICLE 3.7 -- SUBCONTRACTS

A. Subcontractor assignments as identified in the bid form shall not be changed without written approval of the Owner. The Owner will not approve changes of a listed subcontractor unless the Contractor documents, to the satisfaction of the Owner that the subcontractor cannot or will not perform the work as specified.

B. The Contractor is fully responsible to the Owner for the acts and omissions of all subcontractors and of persons either directly or indirectly employed by them.

C. Every subcontractor shall be bound by the applicable terms and provisions of these contract documents, but no contractual relationship shall exist between any subcontractor and the Owner unless the right of the Contractor to proceed with the work is suspended or this contract is terminated as herein provided, and the Owner in writing elects to assume the subcontract.

D. The Contractor shall upon receipt of "Notice to Proceed" and prior to submission of the first payment request, notify the Designer and Construction Representative in writing of the names of any subcontractors to be used in addition to those identified in the bid form and all major material suppliers proposed for all parts of the work.

ARTICLE 4 -- CHANGES IN THE WORK

4.1 CHANGES IN THE WORK

A. The Construction Representative, without giving notice to the surety and without invalidating this contract, may order extra work or make changes by altering, adding to or deducting from the work, this contract sum being adjusted accordingly. All such work shall be executed under the conditions of the original contract. A claim for extension of time caused by any change must be adjusted at the time of ordering such change. No future request for time will be considered.

B. Each Contract Change shall include all costs required to perform the work including all labor, material, equipment, overheads and profit, delay, disruptions, or other miscellaneous expenses. No subsequent requests for additional compensation including claims for delay, disruption, or reduced efficiency as a result of each change will be considered. Values from the Schedule of Values will not be binding as a basis for additions to or deductions from the contract price.

C. The amount of any adjustment in this contract price for authorized changes shall be agreed upon

before such changes become effective and shall be determined, through submission of a request for proposal, as follows:

1. By an acceptable fixed price proposal from the Contractor. Breakdowns shall include all takeoff sheets of each Contractor and subcontractor. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
2. By a cost-plus-fixed-fee (time and material) basis with maximum price, total cost not to exceed said maximum. Breakdown shall include a listing of each item of material with unit prices and number of hours of labor for each task. Labor costs per hour shall be included with labor burden identified, which shall be not less than the prevailing wage rate, etc. Overhead and profit shall be shown separately for each subcontractor and the Contractor.
3. By unit prices contained in Contractor's original bid form and incorporated in the construction contract.

D. Overhead and Profit on Contract Changes shall be applied as follows:

1. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: incidental job burdens, small truck (under 1 ton) expense, mileage, small hand tools, warranty costs, company benefits and general office overhead. Project supervision including field supervision and job site office expense shall be considered a part of overhead and profit unless a compensable time extension is granted.
2. The percentages for overhead and profit charged on Contract Changes shall be subject to the following limits: (a) the percentage mark-up for the Contractor shall be limited to the Contractor's fee; (b) fifteen percent (15%) maximum for Work directly performed by employees of a subcontractor, or sub-subcontractor; (c) five percent (5%) maximum for the Work performed or passed through to the Owner by the Contractor; (d) five percent (5%) maximum subcontractor's mark-up for Work performed by a sub-subcontractor and passed through to the Owner by the subcontractor and Contractor; and (e) in no case shall the total overhead and profit paid by the Owner on any Contract Changes exceed twenty-five percent (25%) of the cost of materials, labor and equipment (exclusive of Contractor or any Subcontractor overhead and profit) necessary to put the contract change work in place.
3. The Contractor will be allowed to add the cost of Contractor's payment and performance bonding, builder's risk insurance, and general liability insurance to their cost of work. The above listed bonding and insurance cost shall not exceed 2% and shall be allowed on the total cost of the added work, including overhead and profit.
4. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work.
5. The percentage(s) for overhead and profit to be credited to the Owner on Contract Changes that are solely decreases in the quantity of work or materials shall be the same as those for additive Contract Changes provided above.

E. No claim for an addition to this contract sum shall be valid unless authorized as aforesaid in writing by the Owner. In the event that none of the foregoing methods are agreed upon, the Owner may order the Contractor to perform work on a time and material basis. The cost of such work shall be determined by the Contractor's actual labor and material cost to perform the work plus overhead and profit as outlined herein. The Designer and Construction Representative shall approve the Contractor's daily time and material invoices for the work involved.

F. If the Contractor claims that any instructions involve extra cost under this contract, the Contractor shall give the Owner's Representative written notice thereof within a reasonable time after the receipt of such instructions, and in any event before proceeding to execute the work. No such claim shall be valid unless so made and authorized by the Owner, in writing.

G. In an emergency affecting the safety of life or of the structure or of adjoining property, the Contractor, without special instruction or authorization from the Construction Representative, is hereby permitted to act at their discretion to prevent such threatened loss or injury. The Contractor shall submit a claim for

compensation for such emergency work in writing to the Owner's Representative.

ARTICLE 4.2 – CHANGES IN COMPLETION TIME

A. Extension of the number of work days stipulated in the Contract for completion of the work with compensation may be made when:

1. The contractor documents that proposed Changes in the work, as provided in Article 4.1, extends construction activities critical to contract completion date, OR
2. The Owner suspends all work for convenience of the Owner as provided in Article 7.3, OR
3. An Owner caused delay extends construction activities critical to contract completion (except as provided elsewhere in these General Conditions). The Contractor is to review the work activities yet to begin and evaluate the possibility of rescheduling the work to minimize the overall project delay.

B. Extension of the number of work days stipulated in the Contract for completion of the work without compensation may be made when:

1. Weather-related delays occur, subject to provisions for the inclusion of a specified number of "bad weather" days when provided for in Section 012100-Allowances, OR
2. Labor strikes or acts of God occur, OR
3. The work of the Contractor is delayed on account of conditions which were beyond the control of the Contractor, subcontractors or suppliers, and were not the result of their fault or negligence.

C. No time extension or compensation will be provided for delays caused by or within the control of the Contractor, subcontractors or suppliers and for concurrent delays caused by the Owner.

D. The Contractor shall notify the Owner promptly of any occurrence or conditions which in the Contractor's opinion results in a need for an extension of time. The notice shall be in writing and shall include all necessary supporting materials with details of any resultant costs and be submitted in time to permit full investigation and evaluation of the Contractor's claim. The Owner shall promptly acknowledge the Contractor's notice and, after recommendation from the Owner's Representative and/or Designer, shall provide a decision to the Contractor. Failure on the part of the Contractor to provide such notice and to detail the costs shall constitute a waiver by the Contractor of any claim. Requests for extensions of time shall be for working days only.

ARTICLE 5 - CONSTRUCTION AND COMPLETION

ARTICLE 5.1 – CONSTRUCTION COMMENCEMENT

A. Upon receipt of the "Intent to Award" letter, the Contractor must submit the following properly executed instruments to the Owner:

1. Contract;
2. Performance/payment bond as described in Article 6.1;
3. Certificates of Insurance, or the actual policies themselves, showing that the Contractor has obtained the insurance coverage required by Article 6.2.
4. Written Affirmative Action Plans as required in Article 1.4.

Above referenced items must be received by the Owner within ten (10) working days after the effective date of the contract. If not received, the Owner may treat the failure to timely submit them as a refusal by the Contractor to accept a contract for this work and may retain as liquidated damages the Contractor's bid bond, cashier's check or certified check as provided in the Instructions to Bidders. Upon receipt the Owner will issue a "Notice to Proceed" with the work to the Contractor.

B. Within the time frame noted in Section 013200 - Schedules, following receipt of the "Notice to Proceed", the Contractor shall submit to the Owner a progress schedule and schedule of values, showing activities through the end of the contract period. Should the Contractor not receive written notification from the Owner of the disapproval of the schedule of values within fifteen (15) working days, the Contractor may consider it approved for purpose of determining when the first monthly Application and Certification for Payment may be submitted.

C. The Contractor may commence work upon receipt of the Division of Facilities Management, Design and Construction's "Notice to Proceed" letter. Contractor shall prosecute the work with faithfulness and energy, and shall complete the entire work on or before the completion time stated in the contract documents or pay to the Owner the damages resulting from the failure to timely complete the work as set out within Article 5.4.

ARTICLE 5.2 -- PROJECT CONSTRUCTION

A. Each Contractor shall submit for the Owner's approval, in reproducible form, a progress schedule showing the rate of progress and the order of the work proposed to carry on various phases of the project. The schedule shall be in conformance with the requirements outlined in Section 013200 – Schedules.

B. Contractor shall employ and supply a sufficient force of workers, material, and equipment and shall pay when due, any worker, subcontractor or supplier and otherwise prosecute the work with such diligence so as to maintain the rate of progress indicated on the progress schedule, prevent work stoppage, and insure completion of the project within the time specified.

ARTICLE 5.3 -- PROJECT COMPLETION

A. Substantial Completion. A Project is substantially complete when construction is essentially complete and work items remaining to be completed can be done without interfering with the Owner's ability to use the Project for its intended purpose.

1. Once the Contractor has reached what they believe is Substantial Completion, the Contractor shall notify the Designer and the Construction Representative of the following:

   a. That work is essentially complete with the exception of certain listed work items. The list shall be referred to as the "Contractor's Punch."

   b. That all Operation and Maintenance Manuals have been assembled and submitted in accordance with Article 3.5A.

   c. That the Work is ready for inspection by the Designer and Construction Representative. The Owner shall be entitled to a minimum of ten working days notice before the inspection shall be performed.

2. If the work is acceptable, the Owner shall issue a Certificate of Substantial Completion, which shall set forth the responsibilities of the Owner and the Contractor for utilities, security, maintenance, damage to the work and risk of loss. The Certificate shall also identify those remaining items of work to be performed by the Contractor. All such work items shall be complete within 30 working days of the date of the Certificate, unless the Certificate specifies a different time. If the Contractor shall be required to perform tests that must be delayed due to climatic conditions, it is understood that such tests and affected equipment will be identified on the Certificate and shall be accomplished by the Contractor at the earliest possible date. Performance of the tests may not be required before Substantial Completion can be issued. The date of the issuance of the Certificate of Substantial Completion shall determine whether or not the work was completed within the contract time and whether or not Liquidated Damages are due.

3. If the work is not acceptable, and the Owner does not issue a Certificate of Substantial Completion, the Owner shall be entitled to charge the Contractor with the Designer's and Owner's costs of re-inspection, including time and travel.

B. Partial Occupancy. Contractor agrees that the Owner shall be permitted to occupy and use any completed or partially completed portions of the Project, when such occupancy and use is in the Owner's best interest. Owner shall notify Contractor of its desire and intention to take Partial Occupancy as soon as possible but at least ten (10) working days before the Owner intends to occupy. If the Contractor believes that the portion of the work the Owner intends to occupy is not ready for occupancy, the Contractor shall notify the Owner immediately. The Designer shall inspect the work in accordance with the procedures above. If the Contractor claims increased cost of the project or delay in completion as a result of the occupancy, he shall notify the Owner immediately but in all cases before occupancy occurs.

C. Final Completion. The Project is finally complete when the Certificate of Substantial Completion has been issued and all work items identified therein as incomplete have been completed, and when all administrative items required by the contract have been completed. Final Completion entitles the Contractor to payment of the outstanding balance of the contract amount including all change orders and retainage. Within five (5) working days of the date of the Certificate of Substantial Completion, the Contractor shall identify the cost to complete any outstanding items of work. The Designer shall review the Contractor's estimate and either approve it or provide an independent estimate for all such items. If the Contractor fails to complete the remaining items within the time specified in the Certificate, the Owner may terminate the contract and go to the surety for project completion in accordance with Article 7.2 or release the contract balance to the Contractor less 150% of the

approved estimate to complete the outstanding items. Upon completion of the outstanding items, when a final cost has been established, any monies remaining shall be paid to the Contractor. Failure to complete items of work does not relieve the Contractor from the obligation to complete the administrative requirements of the contract, such as the provisions of Article 5.3 FAILURE TO COMPLETE ALL ITEMS OF WORK UNDER THE CONTRACT SHALL BE CONSIDERED A DEFAULT AND BE GROUNDS FOR CONTRACT TERMINATION AND DEBARMENT.

D. Liquidated Damages. Contractor agrees that the Owner may deduct from the contract price and retain as liquidated damages, and not as penalty or forfeiture, the sum stipulated in this contract for each work day after the Contract Completion Day on which work is not Substantially Complete. Assessment of Liquidated Damages shall not relieve the Contractor or the surety of any responsibility or obligation under the Contract. In addition, the Owner may, without prejudice to any other rights, claims, or remedies the Owner may have including the right to Liquidated Damages, charge the Contractor for all additional expenses incurred by the Owner and/or Designer as the result of the extended contract period through Final Completion. Additional Expenses shall include but not be limited to the costs of additional inspections.

E. Early Completion. The Contractor has the right to finish the work before the contract completion date; however, the Owner assumes no liability for any hindrances to the Contractor unless Owner caused delays result in a time extension to the contract completion date. The Contractor shall not be entitled to any claims for lost efficiencies or for delay if a Certificate of Substantial Completion is given on or before the Contract Completion Date.

ARTICLE 5.4 -- PAYMENT TO CONTRACTOR

A. Payments on account of this contract will be made monthly in proportion to the work which has been completed. Request for payment must be submitted on the Owner's forms. No other pay request will be processed. Supporting breakdowns must be in the same format as Owner's forms and must provide the same level of detail. The Designer will, within 5 working days from receipt of the contractor's request for payment either issue a Certificate for Payment to the Owner, for such amount as the Designer determines is properly due, or notify the Contractor in writing of reasons for withholding a Certificate. The Owner shall make payment within 30 calendar days after the "Application and Certification for Payment" has been received and certified by the Designer. The following items are to be attached to the contractor's pay request:

1. Updated construction schedule
2. Certified payrolls consisting of name, occupation and craft, number of hours worked and actual wages paid for each individual employee, of the Contractor and all subcontractors working on the project

B. The Owner shall retain 5 percent of the amount of each such payment application, except as allowed by Article 5.4, until final completion and acceptance of all work covered by this contract.

C. Each payment made to Contractor shall be on account of the total amount payable to Contractor and all material and work covered by paid partial payment shall thereupon become the sole property of Owner. This provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made or restoration of any damaged work or as a waiver of the right of Owner to require fulfillment of all terms of this contract.

D. Materials delivered to the work site and not incorporated in the work will be allowed in the Application and Certification for Payment on the basis of one hundred (100%) percent of value, subject to the 5% retainage providing that they are suitably stored on the site or in an approved warehouse in accordance with the following requirements:

1. Material has previously been approved through submittal and acceptance of shop drawings conforming to requirements of Article 3.2 of General Conditions.
2. Delivery is made in accordance with the time frame on the approved schedule.
3. Materials, equipment, etc., are properly stored and protected from damage and deterioration and remain so - if not, previously approved amounts will be deleted from subsequent pay applications.
4. The payment request is accompanied by a breakdown identifying the material equipment, etc. in sufficient detail to establish quantity and value.

E. The Contractor shall be allowed to include in the Application and Certification for Payment, one hundred (100%) of the value, subject to retainage,

of major equipment and material stored off the site if all of the following conditions are met:

1. The request for consideration of payment for materials stored off site is made at least 15 working days prior to submittal of the Application for Payment including such material. Only materials inspected will be considered for inclusion on Application for Payment requests.
2. Materials stored in one location off site are valued in excess of $25,000.
3. That a Certificate of Insurance is provided indicating adequate protection from loss, theft conversion or damage for materials stored off site. This Certificate shall show the State of Missouri as an additional insured for this loss.
4. The materials are stored in a facility approved and inspected, by the Construction Representative.
5. Contractor shall be responsible for, Owner costs to inspect out of state facilities, and any delays in the completion of the work caused by damage to the material or for any other failure of the Contractor to have access to this material for the execution of the work.

F. The Owner shall determine the amount, quality and acceptability of the work and materials which are to be paid for under this contract. In the event any questions shall arise between the parties, relative to this contract or specifications, determination or decision of the Owner or the Construction Representative and the Designer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.

G. Payments Withheld: The Owner may withhold or nullify in whole or part any certificate to such extent as may be necessary to protect the Owner from loss on account of:

1. Defective work not remedied. When a notice of noncompliance is issued on an item or items, corrective action shall be undertaken immediately. Until corrective action is completed, no monies will be paid and no additional time will be allowed for the item or items. The cost of corrective action(s) shall be borne by the Contractor.
2. A reasonable doubt that this contract can be completed for the unpaid balance.
3. Failure of the Contractor to update as-built drawings monthly for review by the Construction Representative.
4. Failure of the Contractor to update the construction schedule.

When the Construction Representative is satisfied the Contractor has remedied above deficiencies, payment shall be released.

H. Final Payment: Upon receipt of written notice from the Contractor to the Designer and Project Representative that the work is ready for final inspection and acceptance, the Designer and Project Representative, with the Contractor, shall promptly make such inspection. If the work is acceptable and the contract fully performed, the Construction Representative shall complete a final acceptance report and the Contractor will be directed to submit a final Application and Certification for Payment. If the Owner approves the same, the entire balance shall be due and payable, with the exception of deductions as provided for under Article 5.4.

1. Where the specifications provide for the performance by the Contractor of (certain tests for the purpose of balancing and checking the air conditioning and heating equipment and the Contractor shall have furnished and installed all such equipment in accordance with the specifications, but said test cannot then be made because of climatic conditions, such test shall may be considered as required under the provisions of the specifications, Section 013300 and this contract may be substantial Full payment will not be made until the tests have been made and the equipment and system is finally accepted. If the tests are not completed when scheduled, the Owner may deduct 150% of the value of the tests from the final payment.
2. The final payment shall not become due until the Contractor delivers to the Construction Representative:

a) A complete file of releases, on the standard form included in the contract documents as "Final Receipt of Payment and Release Form", from subcontractors and material suppliers evidencing payment in full for services, equipment and materials, as the case may require, if the Owner approves, or a consent from the Surety to final payment accepting liability for any unpaid amounts.

b) An Affidavit of Compliance with Prevailing Wage Law, in the form as included in this contract specifications, properly executed by each subcontractor, and the Contractor

c) Certified copies of all payrolls

d) As-built drawings

3. If any claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such a claim including all costs and a reasonable attorney's fee.

4. Missouri statute requires prompt payment from the Owner to the Contractor within thirty calendar days and from the Contractor to his subcontractors within fifteen calendar days. Failure to make payments within the required time frame entitles the receiving party to charge interest at the rate of one and one half percent per month calculated from the expiration of the statutory time period until paid.

5. The value of all unused unit price allowances and/or 150% of the value of the outstanding work items, and/or liquidated damages may be deducted from the final pay request without executing a Contract Change. Any unit price items which exceed the number of units in the contract may be added by Contract Change.

ARTICLE 6 -- INSURANCE AND BONDS

ARTICLE 6.1 -- BOND

A. Contractor shall furnish a performance/payment bond in an amount equal to 100% of the contract price to guarantee faithful performance of the contract and 100% of the contract price to guarantee the payment of all persons performing labor on the project and furnishing materials in connection therewith under this contract as set forth in the standard form of performance and payment bond included in the contract documents. The surety on such bond shall be issued by a surety company authorized by the Missouri Department of Insurance to do business in the state of Missouri.

B. All Performance/Payment Bonds furnished in response to this provision shall be provided by a bonding company with a rating of B+ or higher as established by A.M. Best Company, Inc. in their most recent publication.

ARTICLE 6.2 – INSURANCE

A. The successful Contractor shall procure and maintain for the duration of the contract issued a policy or policies of insurance for the protection of both the Contractor and the Owner and their respective officers, officials, agents, consultants and employees. The Owner requires certification of insurance coverage from the Contractor prior to commencing work.

B. Minimum Scope and Extent of Coverage

1. General Liability

Commercial General Liability, ISO coverage form number or equivalent CG 00 01 ("occurrence" basis), or I-SO coverage form number CG 00 02, or ISO equivalent.

If ISO equivalent or manuscript general liability coverage forms are used, minimum coverage will be as follows: Premises/Operations; Independent Contractors; Products/Completed Operations; personal Injury; Broad Form Property Damage including Completed Operations; Broad Form Contractual Liability Coverage to include Contractor's obligations under Article 1.11 Indemnification and any other Special Hazards required by the work of the contract.

2. Automobile Liability

Business Automobile Liability Insurance, ISO Coverage form number or equivalent CA 00 01 covering automobile liability, code 1 "ANY AUTO".

3. Workers' Compensation and Employer's Liability

Statutory Workers' Compensation Insurance for Missouri and standard Employer's Liability Insurance, or the authorization to self-insure for such liability from the Missouri Division of Workers' Compensation.

4. Builder's Risk or Installation Floater Insurance

Insurance upon the work and all materials, equipment, supplies, temporary structures and similar items which may be incident to the performance of the work and located at or adjacent to the site, against loss or damage from fire and such other casualties as are included in extended coverage in broad "All Risk" form, including coverage for Flood and Earthquake, in an amount not less than the replacement cost of the work or this contact price, whichever is greater, with loss payable

to Contractor and Owner as their respective interests may appear.

Contractor shall maintain sufficient insurance to cover the full value of the work and materials as the work progresses, and shall furnish Owner copies of all endorsements. If Builder's Risk Reporting- Form of Endorsement is used, Contractor shall make all reports as required therein so as to keep in force an amount of insurance which will equal the replacement cost of the work, materials, equipment, supplies, temporary structures, and other property covered thereby; and if, as a result of Contractor's failure to make any such report, the amount of insurance so recoverable shall be less than such replacement cost, Contractor's interest in the proceeds of such insurance, if any, shall be subordinated to Owner's interest to the end that Owner may receive full reimbursement for its loss.

C. Minimum Limits of Insurance

1. General Liability

Contractor

$2,000,000	combined single limit per occurrence for bodily injury, personal injury, and property damage
$2,000,000	annual aggregate

2. Automobile Liability

$2,000,000	combined single limit per occurrence for bodily injury and property damage

3. Workers' Compensation and Employers Liability

Workers' Compensation limits as required by applicable State Statutes (generally unlimited) and minimum of $1,000,000 limit per accident for Employer's Liability.

General Liability and Automobile Liability insurance may be arranged under individual policies for the full limits required or by a combination of underlying policies with the balance provided by a form-following Excess or Umbrella Liability policy.

D. Deductibles and Self-Insured Retentions

All deductibles, co-payment clauses, and self-insured retentions must be declared to and approved by the Owner. The Owner reserves the right to request the reduction or elimination of unacceptable deductibles or self-insured retentions, as they would apply to the Owner, and their respective officers, officials, agents, consultants and employees. Alternatively, the Owner may request Contractor to procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

E. Other Insurance Provisions and Requirements

The respective insurance policies and coverage, as specified below, must contain, or be endorsed to contain the following conditions or provisions:

1. General Liability

The Owner, and its respective commissioners, officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 Additional Insured - Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance of self-insurance programs maintained by the designated additional -insured's shall be excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's general liability insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner, or for any of their officers, officials, agents, consultants or employees.

2. Automobile Insurance

The Owner, and their respective officers, officials, agents, consultants and employees shall be endorsed as additional insured's by ISO form CG 20 26 - Additional Insured Designated Person or Organization. As additional insured's, they shall be covered as to work performed by or on behalf of the Contractor or as to liability which arises out of Contractor's activities or resulting from the

performance of services or the delivery of goods called for by the Contract.

Contractor's insurance coverage shall be primary with respect to all additional insured's. Insurance or self-insurance programs maintained by the designated additional insured's shall be in excess of the Contractor's insurance and shall not contribute with it.

Additionally, the Contractor and Contractor's automobile insurer shall agree to waive all rights of subrogation against the Owner and any of their respective officers, officials, agents, consultants or employees for claims, losses, or expenses which arise out of Contractor's activities or result from the performance of services or the delivery of goods called for by the Contract.

Contractor's failure to comply with the terms and conditions of these insurance policies shall not affect or abridge coverage for the Owner or for any of its officers, officials, agents, consultants or employees.

3. Workers' Compensation/Employer's Liability

Contractor's workers' compensation insurance shall be endorsed with NCCI form WC 00 03 01 A - Alternative Employer Endorsement. The Alternative Employer Endorsement shall designate the Owner as "alternate employers."

4. All Coverages

Each insurance policy required by this section of the Contract shall contain a stipulation, endorsed if necessary, that the Owner will receive a minimum of a thirty (30) calendar day advance notice of any policy cancellation. Ten (10) calendar days advance notice is required for policy cancellation due to non-payment of premium.

F. Insurer Qualifications and Acceptability

Insurance required hereunder shall be issued by an A.M. Best, "B+" rated, Class IX insurance company approved to conduct insurance business in the state of Missouri.

G. Verification of Insurance Coverage

Prior to Owner issuing a Notice to Proceed, the Contractor-shall furnish the Owner with Certificate(s) of Insurance and with any applicable original endorsements evidencing the required insurance coverage. The insurance certificates and endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All certificates and endorsements received by the Owner are subject to review and approval by the Owner. The Owner reserves the right to require certified copies of all required policies at any time. If the scope of this contract will exceed one (1) year - or, if any of Contractor's applicable insurance coverage expires prior to completion of the work or services required under this contract - the Contractor will provide a renewal or replacement certificate before continuing work or services hereunder. If the Contractor fails to provide documentation of required insurance coverage, the Owner may issue a stop work order and no additional contract completion time and/or compensation shall be granted as a result thereof.

ARTICLE 7 – SUSPENSION OR TERMINATION OF CONTRACT

ARTICLE 7.1 - FOR SITE CONDITIONS

When conditions at the site of the proposed work are considered by the Owner to be unsatisfactory for prosecution of the work, the Contractor may be ordered in writing to suspend the work or any part thereof until reasonable conditions exist. When such suspension is not due to fault or negligence of the Contractor, time allowed for completion of such suspended work will be extended by a period of time equal to that lost due to delay occasioned by ordered suspension. This will be a no cost time extension.

ARTICLE 7.2 - FOR CAUSE

A. Termination or Suspension for Cause:

1. If the Contractor shall file for bankruptcy, or should make a general assignment for the benefit of the creditors, or if a receiver should be appointed on account of insolvency, or if the contractor should persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if the contractor should fail to make prompt payment to subcontractors or for material or labor, or persistently disregard laws, ordinances or the instructions of the Owner, or otherwise be guilty of a substantial violation of any provision of this contract, then the Owner may serve notice on the Contractor and the surety setting forth the violations and demanding compliance with this contract. Unless within ten (10) consecutive calendar days after serving such notice, such violations shall cease and satisfactory arrangements for correction be made, the Owner may suspend the Contractor's right to proceed with the work or terminate this contract.

2. In the event the Owner suspends Contractor's right to proceed with the work or terminates the contract, the Owner may demand that the Contractor's surety take over and complete the work on this contract, after the surety submits a written proposal to the Owner and receives written approval and upon the surety's failure or refusal to do so within ten (10) consecutive calendar days after demand therefore, the Owner may take over the work and prosecute the same to completion by bid or negotiated contract, or the Owner may elect to take possession of and utilize in completing the work such materials, supplies, appliances and plant as may be on the site of the work, and all subcontractors, if the Owner elects, shall be bound to perform their contracts.

B. The Contractor and its surety shall be and remain liable to the Owner for any excess cost or damages occasioned to the Owner as a result of the actions above set forth.

C. The Contractor in the event of such suspension or termination shall not be entitled to receive any further payments under this contract until the work is wholly finished. Then if the unpaid balance under this contract shall exceed all expenses of the Owner as certified by the Director, such excess shall be paid to the Contractor; but, if such expenses shall exceed the unpaid balance as certified by the Director, the Contractor and their surety shall be liable for and shall pay the difference and any damages to the Owner.

D. In exercising Owner's right to secure completion of the work under any of the provisions hereof, the Director shall have the right to exercise Owner's sole discretion as to the manner, methods and reasonableness of costs of completing the work.

E. The rights of the Owner to suspend or terminate as herein provided shall be cumulative and not exclusive and shall be in addition to any other remedy provided by law.

F. The Contractor in the event of such suspension or termination may be declared ineligible for Owner contracts for a minimal period of twelve (12) months. Further, no contract will be awarded to any Contractor who lists in their bid form any subcontractor whose prior performance has contributed, as determined by the Owner, to a breach of a contract. In order to be considered for state-awarded contracts after this period, the Contractor/subcontractor will be required to forward acceptance reports to the Owner regarding successful completion of non-state projects during the intervening twelve (12) months from the date of default. No contracts will be awarded to a subcontractor/Contractor until the ability to perform responsibly in the private sector has been proven to the Owner.

ARTICLE 7.3 -- FOR CONVENIENCE

A. The Owner may terminate or suspend the Contract or any portion of the Work without cause at any time, and at the Owner's convenience. Notification of a termination or suspension shall be in writing and shall be given to the Contractor and their surety. If the Contract is suspended, the notice will contain the anticipated duration of the suspension or the conditions under which work will be permitted to resume. If appropriate, the Contractor will be requested to demobilize and re-mobilize and will be reimbursed time and costs associated with the suspension.

B. Upon receipt of notification, the Contractor shall:

1. Cease operations when directed.

2. Take actions to protect the work and any stored materials.

3. Place no further subcontracts or orders for material, supplies, services or facilities except as may be necessary to complete the portion of the Contract that has not been terminated. No claim for payment of materials or supplies ordered after the termination date shall be considered.

4. Terminate all existing subcontracts, rentals, material, and equipment orders.

5. Settle all outstanding liabilities arising from termination with subcontractors and suppliers.

6. Transfer title and deliver to the Owner, work in progress, completed work, supplies and other material produced or acquire for the work terminated, and completed or partially completed plans, drawings information and other property that, if the Contract had been completed, would be required to be furnished to the Owner.

C. For termination without cause and at the Owner's convenience, in addition to payment for work completed prior to date of termination, the Contractor may be entitled to payment of other documented costs directly associated with the early termination of the contract. Payment for anticipated profit and unapplied overhead will not be allowed.

SECTION 007300 - SUPPLEMENTARY CONDITIONS

1.0 GENERAL:

A. These Supplementary General Conditions clarify, add, delete, or otherwise modify standard terms and conditions of DIVISION 0, BIDDING AND CONTRACTING REQUIREMENTS.

2.0 CONTACTS:

Designer:
Jennifer M. Hedrick
SOA Architecture
2801 Woodard Drive, 103
Columbia, MO 65202
Telephone: 573-443-1407
Email: hedrick@soa-inc.com

MONG Project Manager / Construction Representative:
Joey Schaefer
Missouri National Guard-CFMO Office
6819a North Boundary Road
Jefferson City, MO 65101
Telephone: 573-690-4945
Email: joseph.e.schaefer10.nfg@army.mil

Construction Representative:
Ken Sheputis
Division of Facilities Management, Design and Construction
805 Clilnic Rd.
Hannibal, MO 63401
Telephone: 417-576-7161
Email: kenneth.sheputis@oa.mo.gov

Project Manager:
Sandra Walther
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, MO 65101
Telephone: 573-257-7322
Email: sandra.walther@oa.mo.gov

Contract Specialist:
Mandy Roberson
Division of Facilities Management, Design and Construction
301 West High Street, Room 730
Jefferson City, Missouri 65101
Telephone: 573-522-0074
Email: mandy.roberson@oa.mo.gov

3.0 NOTICE: ALL BID MATERIALS ARE DUE AT THE TIME OF BID SUBMITTAL. THERE IS NO SECOND SUBMITTAL FOR THIS PROJECT.

4.0 FURNISHING CONSTRUCTION DOCUMENTS:

A. The Owner will furnish the Contractor with approximately 10 complete sets of drawings and specifications at no charge.

B. The Owner will furnish the Contractor with approximately 10 sets of explanatory or change drawings at no charge.

C. The Contractor may make copies of the documents as needed with no additional cost to the Owner.

5.0 SAFETY REQUIREMENTS

Contractor and subcontractors at any tier shall comply with RSMo 292.675 and Article 1.3, E, of Section 007213, General Conditions.

6.0 ENVIRONMENTAL MANAGEMENT SYSTEM (eMS):

The Missouri Army National Guard (MOARNG) has implemented an Environmental Management System (eMS). One of the key components of the eMS is the establishment of an Environmental Policy that must be communicated to all persons working for or on behalf of the organization including all suppliers and contractors. This policy stresses commitment to compliance with accepted environmental practices, and meeting or exceeding applicable environmental requirements, legal and otherwise. This policy also stresses commitment to waste minimization, pollution prevention, and management of personnel, processes, real property, and materials in a manner to reduce environmental impacts. The policy is available upon request to all parties by contacting the Environmental Management Office at (573) 638-9514.

Missouri
Division of Labor Standards
WAGE AND HOUR SECTION

MICHAEL L. PARSON, Governor

Annual Wage Order No. 31

Section 004
AUDRAIN COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: **March 8, 2024**

Last Date Objections May Be Filed: **April 8, 2024**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	$25.76*
Boilermaker	$25.76*
Bricklayer-Stone Mason	$25.76*
Carpenter	$58.89
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	$25.76*
Plasterer	
Communication Technician	$25.76*
Electrician (Inside Wireman)	$57.87
Electrician Outside Lineman	$25.76*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	$25.76*
Glazier	$25.76*
Ironworker	$25.76*
Laborer	$25.76*
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	$25.76*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	$25.76*
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	$25.76*
Plumber	$69.40
Pipe Fitter	
Roofer	$25.76*
Sheet Metal Worker	$57.82
Sprinkler Fitter	$25.76*
Truck Driver	$25.76*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.
**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290.210.

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	$25.76*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	$25.76*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	$25.76*
General Laborer	
Skilled Laborer	
Operating Engineer	$25.76*
Group I	
Group II	
Group III	
Group IV	
Truck Driver	$25.76*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME
and
HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, **"overtime work"** shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

SECTION 011000 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Project consists of interior and exterior renovation of the Mexico Readiness Center.

1. Project Location: 917 W Curtis St, Mexico, MO 65265
2. Owner: State of Missouri, Office of Administration, Division of Facilities Management, Design and Construction, Harry S Truman State Office Building, Post Office Box 809, 301 West High Street, Jefferson City, Missouri 65102.

B. Contract Documents, dated May 31, 2024 were prepared for the Project by SOA Architecture, 2801 Woodard Drive, Suite 103, Columbia, MO, 65202.

C. The Work consists of modifications to three separate buildings and the site:

1. Readiness Center Building:
   (i) Interior work includes a total gut and reconfiguration of the men's and women's restrooms and showers, kitchen and scullery including removal and replacement of the interior floor slab. For the remainder of the building, offices and classrooms will receive new interior finishes, doors, ceilings, operable partition, new HVAC and lighting.
      1. Some portions of the commercial kitchen equipment are identified as bid Alternate No. 1.
   (ii) Exterior work includes a new membrane roof, EIFS repairs and replacement, replacement of the sectional overhead door, pedestrian door and windows.
   (iii) Replacement of the main entrance with a bullet resistant unit is identified as bid Alternate No. 4.
2. Cold Storage Building work includes removal of PEMB exterior metal siding, repairs to damaged structure, installation of new metal siding, the addition of insulation to underside of the existing roof, and replacement of sectional overhead and pedestrian doors. All work associated with Cold Storage Building is part of bid Alternate No. 2. The Base Bid excludes all work.
3. Old FMS Building includes removal and replacement of interior finishes in the office, restroom and two storage rooms. The large vehicle storage bays will be power washed. Existing LED light fixtures will be reused. All work associated with Old FMS Building is part of bid Alternate No. 3. The Base Bid excludes all work.
4. Site work includes replacement and addition of paving, drives, sidewalks, and fencing.

D. The Work will be constructed under a single prime contract.

1.3 WORK UNDER OTHER CONTRACTS (Not Applicable)

1.4 FUTURE WORK (Not Applicable)

1.5 WORK SEQUENCE

A. The Work will be conducted in one (1) phase.

1.6 CONTRACTOR USE OF PREMISES

A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises limited only by the Owner's right to perform work or to retain other contractors on portions of the Project.

B. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy

2. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of the Existing Building: Maintain the existing building in a weathertight condition throughout the construction period. Repair damage cause by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period..

1.7 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate owner usage. Perform the Work so as not to interfere with the Owner's operations.

1.8 OWNER-FURNISHED PRODUCTS

A. The Owner will furnish select restroom items including paper towel dispensers and soap dispensers.
   a. The Owner will arrange for and deliver necessary shop drawings, product data, and samples to the Contractor.
   b. The Owner will arrange and pay for delivery of Owner-furnished items according to the contractor's Construction Schedule.
   c. The Contractor is responsible for receiving, unloading and handling Owner furnished items at the site.
   d. Following delivery, the Contractor will inspect items delivered for damage. The Contractor shall not accept damaged items and shall notify the Owner of rejection of damaged items.
   e. If Owner-furnished items are damaged, defective, or missing, the Owner will arrange for replacement.
   f. The Contractor shall designate delivery dates of Owner-furnished items in the Contractor's Construction Schedule.
   g. The Contractor shall review shop drawings, product data and samples and return them to the Designer noting discrepancies or problems anticipated in use of the project.
   h. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements. The Contractor shall repair or replace items damaged as a result of his operations.

1.9 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF PRODUCTS ORDERED IN ADVANCE (Not Applicable)

END OF SECTION 011000

SECTION 012100 – ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Weather allowances.

C. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
2. Division 1 Section "Unit Prices" for procedures for using unit prices.

1.3 WEATHER ALLOWANCE

A. Included within the completion period for this project are a specified number of “bad weather” days (see Schedule of Allowances).

B. The Contractor’s progress schedule shall clearly indicate the bad weather day allowance as an “activity” or “activities”. In the event weather conditions preclude performance of critical work activities for 50% or more of the Contractor’s scheduled workday, that day shall be declared unavailable for work due to weather (a “bad weather” day) and charged against the above allowance. Critical work activities will be determined by review of the Contractor’s current progress schedule.

C. The Contractor’s Representative and the Construction Representative shall agree monthly on the number of “bad weather” days to be charged against the allowance. This determination will be documented in writing and be signed by the Contractor and the Construction Representatives. If there is a failure to agree on all or part of the “bad weather” days for a particular month, that disagreement shall be noted on this written document and signed by each party’s representative. Failure of the Contractor’s representative to sign the “bad weather” day documentation after it is presented, with or without the notes of disagreement, shall constitute agreement with the “bad weather” day determination contained in that document.

D. There will be no modification to the time of contract performance due solely to the failure to deplete the “bad weather” day allowance.

E. Once this allowance is depleted, a no cost Change Order time extension will be executed for “bad weather” days, as defined above, encountered during the remainder of the Project.

1.4 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, Designer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Designer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Designer from the designated supplier.

1.5 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES (Not Applicable)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Weather Allowance: Included within the completion period for this Project twenty-five (25) “bad weather” days.

END OF SECTION 012100

SECTION 012200 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

B. Quantities of Units to be included in the Base Bid are indicated in Section 004322 – Unit Prices.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Unit Prices.

B. Related Sections include the following:

1. Division 1 Section "Allowances" for procedures for using Unit Prices to adjust quantity allowances.
2. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Division 7 Section "072413 POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)" for procedures for measurement and payment for additional EIFS repair and patching beyond those documented in the Drawings.

1.3 DEFINITIONS

A. Unit Price is an amount proposed by bidders, stated on the Bid Form Attachment 004322 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.

1.4 PROCEDURES

A. Unit Prices include all necessary material plus cost for delivery, installation, insurance, **applicable taxes,** overhead, and profit.

B. Measurement and Payment: Refer to 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 surveyor 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 LIST OF UNIT PRICES

A. Unit Price No 1: EIFS Repair and Patching

1. Description: The existing EIFS requires repairs and patching as illustrated in the Exterior Elevations of the Drawings. Patch/Repair EIFS according to Division 7 Section 072413 POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)."

2. Unit of Measurement: Square Foot

3. Base Bid Quantity: 1,120 square feet of patching and repairing EIFS on existing exterior walls.

   This Base Bid Quantity excludes repair for organic growth and excludes new EIFS construction at the clerestory.

END OF SECTION 012200

SECTION 012300 – ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Bid Form and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing Alternates.

1.3 DEFINITIONS

A. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents..

1. The cost for each alternate is the net addition to the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

B. No additional time will be allowed for alternate work unless the number of work days is so stated on the bid form.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate the Alternate Work into the Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

B. Notification: The award of the Contract will indicate whether alternates have been accepted or rejected.

C. Execute accepted alternates under the same conditions as other Work of this Contract.

D. Schedule: A “Schedule of Alternates” is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials necessary to achieve the Work described under each alternate.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Add commercial kitchen equipment in FOOD PREP 121B and SCULLERY 121A as identified on Foodservice Drawing Q-FP-01 EQUIPMENT SCHEDULE.
   1. Base bid is to include kitchen equipment per Q-FP-01 EQUIPMENT SCHEDULE, all work associated with the fire suppression and exhaust hood, and all electrical, gas, and plumbing infrastructure for the DRY STORAGE 120, FOOD PREP 121B and SCULLERY 121A.

B. Alternate No. 2: Add call demolition and new work associated with the Cold Storage / pre-engineered metal building.
   1. Base bid excludes all work to Cold Storage / Pre-engineered metal building.

C. Alternate No. 3: Add all demolition and new work associated with the Old FMS Building.
   1. Base bid excludes all work to the Old FMS Building.

D. Alternate No. 4: Replace existing LOBBY 100 entrance door 100A with a bullet-resistant security aluminum entrance system including security glazing.
   1. Base bid is to include upgrades to the existing door operator. All other door and hardware components will remain as-is.

END OF SECTION

SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract Modifications.

B. Related Sections include the following:

1. Division 1, Section 012100 "Allowances" for procedural requirements for handling and processing Allowances.
2. Division 1, Section 012200 "Unit Prices" for administrative requirements for using Unit Prices.
3. Division 1, Section 013115 “Project Management and Coordination” for administrative requirements for communications.
4. Division 0, Section 007213, Article 3.1 "Acceptable Substitutions" for administrative procedures for handling Requests for Substitutions made after Contract award.
5. Division 0, Section 007213, Article 4.0 "Changes in the Work" for Change Order requirements.

1.3 REQUESTS FOR INFORMATION

A. In the event that the Contractor or Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Documents requires clarification or interpretation, the Contractor shall submit a “Request for Information” (RFI) in writing to the Designer. A RFI may only be submitted by the Contractor and shall only be submitted on the RFI forms provided by the Owner. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

B. Responses to RFI shall be issued within ten (10) working days of receipt of the Request from the Contractor unless the Designer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Designer, the Designer will, within five (5) working days of receipt of the request, notify the Contractor of the anticipated response time. If the Contactor submits a RFI on a time sensitive activity on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Designer to respond to the request provided that the Designer responds within the ten (10) working days set forth above.

C. Responses from the Designer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a RFI will cause a change to the requirements of the Contract Document, the Contractor shall give written notice to the Designer requesting a Change Order for the work. Failure to give such written notice within ten (10) working days, shall waive the Contractor’s right to seek additional time or cost under Article 4, “Changes in the Work” of the General Conditions.

1.4 MINOR CHANGES IN THE WORK

A. Designer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Amount or the Contract Time, on ”Designer’s Supplemental Instructions” (DSI).

1.5 PROPOSAL REQUESTS

A. The Designer or Owner Representative will issue a detailed description of proposed Changes in the Work that may require adjustment to the Contract Amount or the Contract Time. The proposed Change Description will be issued using the “Request for Proposal” (RFP) form. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by the Designer or Owner Representative are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.

2. Within ten (10) working days after receipt of Proposal Request, submit a proposal for the cost adjustments to the Contract Amount and the Contract Time necessary to execute the Change. The Contractor shall submit his proposal on the appropriate Change Order Detailed Breakdown form. Subcontractors may use the appropriate Change Order Detailed Breakdown form or submit their proposal on their letterhead provided the same level of detail is included. All proposals shall include:

   a. A detailed breakdown of costs per Article 4.1 of the General Conditions.

   b. If requesting additional time per Article 4.2 of the General Conditions, include an updated Contractor's Construction Schedule that indicates the effect of the Change including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Designer or Owner Representative will issue a Change Order for signatures of Owner and Contractor on the “Change Order” form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 013100 – COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Projects including, but not limited to, the following:

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.

B. Each Contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific Contractor.

C. Related Sections include the following:

1. Division 1, Section 013200 "Schedules" for preparing and submitting Contractor's Construction Schedule.
2. Articles 1.8.B and 1.8.C of Section 007213 "General Conditions" for coordinating meetings onsite.
3. Article 5.4.H of Section 007213 "General Conditions" for coordinating Closeout of the Contract.

1.3 COORDINATION

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, which depend on each other for proper installation, connection, and operation.

B. Coordination: Each Contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with 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 with other Contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components including mechanical and electrical.

C. 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.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other Contractors 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. Startup and adjustment of systems.
8. Project Closeout activities.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings for all above ceiling work. Space availability necessitates maximum utilization of space for efficient installation of different components and coordination is required for installation of products and materials fabricated by separate entities.

B. Key Personnel Names: Within fifteen (15) work 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 and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys 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.

1.5 PROJECT MEETINGS

A. The Owner’s Construction Representative will schedule a Pre-Construction Meeting prior to beginning of construction. The date, time, and exact place of this meeting will be determined after Contract Award and notification of all interested parties. The Contractor shall arrange to have the Job Superintendent and all prime Subcontractors present at the meeting. During the Pre-Construction Meeting, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed along with any other pertinent information.

1. Minutes: Designer will record and distribute meeting minutes.

B. Progress Meetings: The Owner's Construction Representative will conduct Monthly Progress Meetings as stated in Articles 1.8.B and 1.8.C of Section 007213 "General Conditions".

1. Minutes: Designer will record and distribute to Contractor the meeting minutes.

C. Preinstallation Conferences: Contractor shall conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. 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 Designer and Construction Representative of scheduled meeting dates.

2. 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 problems
   k. Time schedules
   l. Weather limitations
   m. Manufacturer's written recommendations
   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

3. Contractor shall record significant conference discussions, agreements, and disagreements including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

5. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013115 - PROJECT MANAGEMENT COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

B. Division 1, Section 013300 - Submittals

C. Division 1, Section 012600 – Contract Modification Procedures

1.2 SUMMARY

A. Project Management Communications: The Contractor shall use the Internet web based project management communications tool, E-Builder® ASP software, and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
   1. Project management communications is available through E-Builder® as provided by "e-Builder®" in the form and manner required by the Owner.
   2. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited

B. Support: E-Builder® will provide on-going support through on-line help files.

C. Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.

D. Purpose: The intent of using E-Builder® is to improve project work efforts by promoting timely initial communications and responses. Secondly, to reduce the number of paper documents while providing improved record keeping by creation of electronic document files

E. Authorized Users: Access to the web site will be by individuals who are authorized users.
   1. Individuals shall complete the E-Builder New Company/User Request Form located at the following web site: https://oa.mo.gov/facilities/vendor-links/contractor-forms. Completed forms shall be emailed to the following email address: OA.FMDCE-BuilderSupport@oa.mo.gov.
   2. Authorized users will be contacted directly and assigned a temporary user password.
   3. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.

F. Administrative Users: Administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE! Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s).

G. Communications: The use of fax, email and courier communication for this project is discouraged in favor of using E-Builder® to send messages. Communication functions are as follows:
   1. Document Integrity and Revisions:
      a. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
      b. The system shall make it easy to identify revised or superseded documents and their predecessors.
      c. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
   2. Document Security:
      a. The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!
   3. Document Integration:
      a. Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.
   4. Reporting:
      a. The system shall be capable of generating reports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.
   5. Notifications and Distribution:
      a. Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
   6. Required Document Types:
      a. RFI, Request for Information.
      b. Submittals, including record numbering by drawing and specification section.
      c. Transmittals, including record of documents and materials delivered in hard copy.
      d. Meeting Minutes.
      e. Application for Payments (Draft or Pencil).
      f. Review Comments.
      g. Field Reports.
      h. Construction Photographs.
      i. Drawings.
      j. Supplemental Sketches.
      k. Schedules.
      l. Specifications.
      m. Request for Proposals
      n. Designer’s Supplemental Instructions
      o. Punch Lists

H. Record Keeping: Except for paper documents, which require original signatures and large format documents (greater than 8½ x 11 inches), all other 8½ x 11 inches documents shall be submitted by transmission in electronic form to the E-Builder® web site by licensed users.
      a. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier shall respond to

documents received in electronic form on the web site, and consider them as if received in paper document form.

b. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.

c. The Owner and his representatives, the Designer and his consultants, and the Contractor and his Sub Contractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.

I. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Owner and his representatives, the Construction Manager and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier required to have a user license(s) shall be responsible for the following:

1. Providing suitable computer systems for each licensed user at the users normal work location[1] with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
2. Each of the above referenced computer systems shall have the following minimum system[2] and software requirements:
   a. Desktop configuration (Laptop configurations are similar and should be equal to or exceed desktop system.)
      1) Operating System: Windows XP or newer
      2) Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+)
      3) Minimum Recommend Connection Speed: 256K or above
      4) Processor Speed: 1 Gigahertz and above
      5) RAM: 512 mb
      6) Operating system and software shall be properly licensed.
      7) Internet Explorer version 7 (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
      8) Adobe Acrobat Reader (current version is a free distribution for download).
      9) Users should have the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 013115

[1] The normal work location is the place where the user is assigned for more than one-half of his time working on this project.

[2] The minimum system herein will not be sufficient for many tasks and may not be able to process all documents and files stored in the E-Builder® Documents area.

SECTION 01 3200 – SCHEDULE – BAR CHART

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for a Bar Chart Schedule for the project construction activities, schedule of submittals, and schedule for testing.

PART 2 - PRODUCTS – (Not Applicable)

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

A. The Contractor shall submit to the Designer, within ten (10) working days following the Notice to Proceed, a Progress Schedule including Schedule of Values showing the rate of progress the Contractor agrees to maintain and the order in which he proposed to carry out the various phases of Work. No payments shall be made to the Contractor until the Progress Schedule has been approved by the Owner.

1. The Schedule of Values must have the following line items included with the value of the item as indicated below:

   a. O&M's (Owner's Manual)

      1) $1,000,000.00 (One million) and under – 2% of the total contract amount
      2) Over $1,000,000.00 (One million) – 1% of the total contract amount

   b. Close Out Documents

      1) $1,000,000.00 (One million) and under – 2% of the total contract amount
      2) Over $1,000,000.00 (One million) – 1% of the total contract amount

   c. General Conditions

      1) No more than 10%

B. The Contractor shall submit an updated Schedule for presentation at each Monthly Progress Meeting. The Schedule shall be updated by the Contractor as necessary to reflect the current Schedule and its relationship to the original Schedule. The updated Schedule shall reflect any

changes in the logic, sequence, durations, or completion date. Payments to the Contractor shall be suspended if the Progress Schedule is not adequately updated to reflect actual conditions.

C. The Contractor shall submit Progress Schedules to Subcontractors to permit coordinating their Progress Schedules to the general construction Work. The Contractor shall coordinate preparation and processing of Schedules and reports with performance of other construction activities.

3.2 CONSTRUCTION PROGRESS SCHEDULE – BAR CHART SCHEDULE

A. Bar-Chart Schedule: The Contractor shall prepare a comprehensive, fully developed, horizontal bar chart-type Contractor's Construction Schedule. The Contractor for general construction shall prepare the Construction Schedule for the entire Project. The Schedule shall show the percentage of work to be completed at any time, anticipated monthly payments by Owner, as well as significant dates (such as completion of excavation, concrete foundation work, underground lines, superstructure, rough-ins, enclosure, hanging of fixtures, etc.) which shall serve as check points to determine compliance with the approved Schedule. The Schedule shall also include an activity for the number of "bad" weather days specified in Section 01 2100 – Allowances.

1. The Contractor shall provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.

    a. If practical, use the same Schedule of Values breakdown for schedule time bars.

2. The Contractor shall provide a base activity time bar showing duration for each construction activity. Each bar is to indicate start and completion dates for the activity. The Contractor is to place a contrasting bar below each original schedule activity time for indicating actual progress and planned remaining duration for the activity.
3. The Contractor shall prepare the Schedule on a minimal number of separate sheets to readily show the data for the entire construction period.
4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on schedule with other construction activities. Include minor elements involved in the overall sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.
6. Indicate the Intent to Award and the Contract Substantial Completion dates on the schedule.

B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by the following:

1. Requirement for Phased completion
2. Work by separate Contractors
3. Work by the Owner
4. Pre-purchased materials
5. Coordination with existing construction
6. Limitations of continued occupancies
7. Un-interruptible services
8. Partial Occupancy prior to Substantial Completion

9. Site restrictions
10. Provisions for future construction
11. Seasonal variations
12. Environmental control

C. Work Stages: Use crosshatched bars to indicate important stages of construction for each major portion of the Work. Such stages include, but are not necessarily limited to, the following:

1. Subcontract awards
2. Submittals
3. Purchases
4. Mockups
5. Fabrication
6. Sample testing
7. Deliveries
8. Installation
9. Testing
10. Adjusting
11. Curing
12. Startup and placement into final use and operation

D. Area Separations: Provide a separate time bar to identify each major area of construction for each major portion of the Work. For the purposes of this Article, a "major area" is a story of construction, a separate building, or a similar significant construction element.

1. 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 the electrical portion of the Work
e. Substantial Completion

3.3 SCHEDULE OF SUBMITTALS

A. Upon acceptance of the Construction Progress Schedule, prepare and submit a complete schedule of submittals. Coordinate the submittal schedule with Section 01 3300 SUBMITTALS, the approved Construction Progress Schedule, list of subcontracts, Schedule of Values and the list of products.

B. Prepare the schedule in chronological order. Provide the following information

1. Scheduled date for the first submittal
2. Related Section number
3. Submittal category
4. Name of the Subcontractor
5. Description of the part of the Work covered
6. Scheduled date for resubmittal
7. Scheduled date for the Designer's final release or approval

C. Distribution: Following the Designer's response to the initial submittal schedule, print and distribute copies to the Designer, Owner, subcontractors, and other parties required to comply with submittal dates indicated.

1. Post copies in the Project meeting room and temporary field office.

2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

3.4 SCHEDULE OF INSPECTIONS AND TESTS

A. Prepare a schedule of inspections, tests, and similar services required by the Contract Documents. Submit the schedule with (15) days of the date established for commencement of the Contract Work. The Contractor is to notify the testing agency at least (5) working days in advance of the required tests unless otherwise specified.

B. Form: This schedule shall be in tabular form and shall include, but not be limited to, the following:

1. Specification Section number
2. Description of the test
3. Identification of applicable standards
4. Identification of test methods
5. Number of tests required
6. Time schedule or time span for tests
7. Entity responsible for performing tests
8. Requirements for taking samples
9. Unique characteristics of each service

C. Distribution: Distribute the schedule to the Owner, Architect, and each party involved in performance of portions of the Work where inspections and tests are required.

END OF SECTION 01 3200

SECTION 013300 – SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

B. Division 1, Section 013115 “Project Management and Coordination” for administrative requirements for communications.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work including the following:

1. Shop Drawings
2. Product Data
3. Samples
4. Quality Assurance Submittals
5. Construction Photographs
6. Operating and Maintenance Manuals
7. Warranties

B. Administrative Submittals: Refer to General and Supplementary Conditions other applicable Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Construction Progress Schedule including Schedule of Values
2. Performance and Payment Bonds
3. Insurance Certificates
4. Applications for Payment
5. Certified Payroll Reports
6. Partial and Final Receipt of Payment and Release Forms
7. Affidavit – Compliance with Prevailing Wage Law
8. Record Drawings
9. Notifications, Permits, etc.

C. The Contractor is obliged and responsible to check all shop drawings and schedules to assure compliance with contract plans and specifications. The Contractor is responsible for the content of the shop drawings and coordination with other contract work. Shop drawings and schedules shall indicate, in detail, all parts of an Item or Work including erection and setting instructions and integration with the Work of other trades.

D. The Contractor shall at all times make a copy, of all approved submittals, available on site to the Construction Representative.

1.3 SUBMITTAL PROCEDURES

A. The Contractor shall comply with the General and Supplementary Conditions and other applicable sections of the Contract Documents. The Contractor shall submit, with such promptness as to cause no delay in his work or in that of any other contractors, all required submittals indicated in Part 3.1 of this section and elsewhere in the Contract Documents. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    a. The Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

B. Each drawing and/or series of drawings submitted must be accompanied by a letter of transmittal giving a list of the titles and numbers of the drawings. Each series shall be numbered consecutively for ready reference and each drawing shall be marked with the following information:

1. Date of Submission
2. Name of Project
3. Location
4. Section Number of Specification
5. State Project Number
6. Name of Submitting Contractor
7. Name of Subcontractor
8. Indicate if Item is submitted as specified or as a substitution

1.4 SHOP DRAWINGS

A. Comply with the General Conditions, Article 3.2.

B. The Contractor shall submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

C. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings including the following information:

1. Dimensions
2. Identification of products and materials included by sheet and detail number
3. Compliance with specified standards
4. Notation of coordination requirements
5. Notation of dimensions established by field measurement
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8½”x11” but no larger than 36”x48”.

1.5 PRODUCT DATA

A. The Contractor shall comply with the General Conditions, Article 3.2.

B. The Contractor shall collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information including the following information:

   a. Manufacturer's printed recommendations

   b. Compliance with Trade Association standards

   c. Compliance with recognized Testing Agency standards

   d. Application of Testing Agency labels and seals

   e. Notation of dimensions verified by field measurement

   f. Notation of coordination requirements

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

1.6 SAMPLES

A. The Contractor shall comply with the General Conditions, Article 3.2.

B. The Contractor shall submit full-size, fully fabricated samples, cured and finished as specified, and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1. The Contractor shall mount or display samples in the manner to facilitate review of qualities indicated. Prepare samples to match the Designer's sample including the following:

   a. Specification Section number and reference

   b. Generic description of the Sample

   c. Sample source

   d. Product name or name of the Manufacturer

   e. Compliance with recognized standards

   f. Availability and delivery time

2. The Contractor shall submit samples for review of size, kind, color, pattern, and texture. Submit samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

   a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.

   b. Refer to other Specification Sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

   c. Refer to other Sections for samples to be returned to the Contractor for incorporation in the Work. Such samples must be undamaged at time of

use. On the transmittal, indicate special requests regarding disposition of sample submittals.

d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

3. Field samples are full-size examples erected onsite to illustrate finishes, coatings, or finish materials and to establish the Project standard.

a. The Contractor shall comply with submittal requirements to the fullest extent possible. The Contractor shall process transmittal forms to provide a record of activity.

1.7 QUALITY ASSURANCE DOCUMENTS

A. The Contractor shall comply with the General Conditions, Article 3.2

B. The Contractor shall submit quality control submittals including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

C. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the Manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the Manufacturer or other individual authorized to contractually bind the Company.

D. Inspection and Test Reports: The Contractor shall submit the required inspection and test reports from independent testing agencies as specified in this Section and in other Sections of the Contract Documents.

E. Construction Photographs: The Contractor shall submit record construction photographs as specified in this Section and in other Sections of the Contract Documents.

1. The Contractor shall submit digital photographs. The Construction Administrator shall determine the quantity and naming convention at the preconstruction meeting.

2. The Contractor shall identify each photograph with project name, location, number, date, time, and orientation.

3. The Contractor shall submit progress photographs monthly unless specified otherwise. Photographs shall be taken one (1) week prior to submitting.

4. The Contractor shall take four (4) site photographs from differing directions and a minimum of five (5) interior photographs indicating the relative progress of the Work.

1.8 OPERATING AND MAINTENANCE MANUALS AND WARRANTIES

A. The Contractor shall submit all required manufacturer's operating instructions, maintenance/service manuals, and warranties in accordance with the General Conditions, Article 3.5, and Supplementary Conditions along with this and other Sections of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REQUIRED SUBMITTALS

A. Contractor shall submit the following information for materials and equipment to be provided under this contract.

SPEC SECTION	TITLE	CATEGORY
013200	Schedules	Construction Schedule
013200	Schedules	Schedule of Values
013200	Schedules	List of Subcontractors
013200	Schedules	Major Material Suppliers
013513.28	Site Security and Health Requirements (MONG)	Major Material Suppliers
013513.28	Site Security and Health Requirements (MONG)	Construction Schedule
013513.28	Site Security and Health Requirements (MONG)	List of Subcontractors
015000	Construction Facilities and Temporary Controls	Construction Schedule
017900	Demonstration and Training	Operation / Maintenance Manual
017900	Demonstration and Training	List of Subcontractors
033000	Cast-in-Place Concrete	Product Data
033000	Cast-in-Place Concrete	Certification
033000	Cast-in-Place Concrete	Test Report
035413	Gypsum Cement Underlayment	Product Data
035413	Gypsum Cement Underlayment	Certification
044200	Concrete Unit Masonry	Product Data
051200	Structural Steel Framing	Shop Drawings
051200	Structural Steel Framing	Certification
051200	Structural Steel Framing	Test Report
054000	Cold-Formed Metal Framing	Product Data
054000	Cold-Formed Metal Framing	Shop Drawings
054000	Cold-Formed Metal Framing	Certification
054000	Cold-Formed Metal Framing	Test Report
055000	Metal Fabrications	Product Data
055000	Metal Fabrications	Shop Drawings
064116	Plastic-Laminate-Clad Architectural Cabinets	Product Data
064116	Plastic-Laminate-Clad Architectural Cabinets	Shop Drawings
064116	Plastic-Laminate-Clad Architectural Cabinets	Sample
072413	Polymer-Based Exterior Insulation and Finish System (EIFS)	Product Data
072413	Polymer-Based Exterior Insulation and Finish System (EIFS)	Sample
072413	Polymer-Based Exterior Insulation and Finish System (EIFS)	Warranty
072723	Board Product Air Barriers	Product Data
072723	Board Product Air Barriers	Warranty
075323	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	Product Data
075323	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	Warranty

075323	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	Operation / Maintenance Manual
076200	Sheet Metal Flashing and Trim	Shop Drawings
076200	Sheet Metal Flashing and Trim	Sample
076200	Sheet Metal Flashing and Trim	Product Data
077100	Roof Specialties	Product Data
077100	Roof Specialties	Warranty
077200	Roof Accessories - Roof Hatch	Shop Drawings
077200	Roof Accessories - Roof Hatch	Product Data
079200	Joint Sealants	Product Data
079200	Joint Sealants	Sample
081113	Hollow Metal Doors and Frames	Product Data
081113	Hollow Metal Doors and Frames	Shop Drawings
083250	Bullet-Resistant Security Aluminum Windows, Doors and Frames	Product Data
083250	Bullet-Resistant Security Aluminum Windows, Doors and Frames	Shop Drawings
083250	Bullet-Resistant Security Aluminum Windows, Doors and Frames	Test Report
083113	Access Doors and Frames	Product Data
083313	Coiling Counter Doors	Product Data
083313	Coiling Counter Doors	Shop Drawings
083313	Coiling Counter Doors	Sample
083313	Coiling Counter Doors	Operation / Maintenance Manual
083613	Sectional Doors	Product Data
083613	Sectional Doors	Shop Drawings
083613	Sectional Doors	Sample
083613	Sectional Doors	Operation / Maintenance Manual
084313	Aluminum-Framed Storefronts	Product Data
084313	Aluminum-Framed Storefronts	Shop Drawings
084313	Aluminum-Framed Storefronts	Warranty
085113	Aluminum Windows	Product Data
085113	Aluminum Windows	Shop Drawings
085113	Aluminum Windows	Warranty
087100	Door Hardware	Product Data
087100	Door Hardware	Product Data
087100	Door Hardware	Warranty
087100	Door Hardware	Operation / Maintenance Manual
087113	Power Door Operators	Product Data
087113	Power Door Operators	Shop Drawings
087113	Power Door Operators	Certification
087113	Power Door Operators	Warranty
087113	Power Door Operators	Operation / Maintenance Manual
088000	Glazing	Product Data
088000	Glazing	Sample
088000	Glazing	Warranty
088300	Mirrors	Product Data

088853	Security Glazing	Product Data
088853	Security Glazing	Sample
088853	Security Glazing	Test Report
088853	Security Glazing	Warranty
092216	Non-Structural Metal Framing	Product Data
092900	Gypsum Board	Product Data
092900	Gypsum Board	Product Data
095113	Acoustical Panel Ceilings	Product Data
095113	Acoustical Panel Ceilings	Operation / Maintenance Manual
096513	Resilient Base and Accessories	Product Data
096519	Resilient Tile Flooring	Product Data
096519	Resilient Tile Flooring	Sample
096519	Resilient Tile Flooring	Operation / Maintenance Manual
096723	Resinous Epoxy Flooring and Resinous Wall System	Product Data
096723	Resinous Epoxy Flooring and Resinous Wall System	Certification
096723	Resinous Epoxy Flooring and Resinous Wall System	Operation / Maintenance Manual
096723	Resinous Epoxy Flooring and Resinous Wall System	Sample
099113	Exterior Painting	Product Data
099113	Exterior Painting	Sample
099123	Interior Painting	Product Data
099123	Interior Painting	Sample
099723	Concrete and Masonry Coatings	Product Data
102113.19	Plastic Toilet Compartments	Product Data
102113.19	Plastic Toilet Compartments	Shop Drawings
102113.19	Plastic Toilet Compartments	Sample
102113.19	Plastic Toilet Compartments	Operation / Maintenance Manual
102239	Folding Panel Partitions	Product Data
102239	Folding Panel Partitions	Shop Drawings
102239	Folding Panel Partitions	Sample
102239	Folding Panel Partitions	Warranty
102239	Folding Panel Partitions	Operation / Maintenance Manual
102600	Wall and Door Protection	Product Data
102600	Wall and Door Protection	Sample
102600	Wall and Door Protection	Operation / Maintenance Manual
102613	RFP Panels	Product Data
102800	Toilet, Bath, and Laundry Accessories	Product Data
102800	Toilet, Bath, and Laundry Accessories	Warranty
104413	Fire Protection Cabinets	Product Data
114000	Foodservice Equipment	Shop Drawings
114000	Foodservice Equipment	Product Data
114000	Foodservice Equipment	Major Material Suppliers
122113	Horizontal Louver Blinds	Product Data
122113	Horizontal Louver Blinds	Shop Drawings
122113	Horizontal Louver Blinds	Operation / Maintenance Manual
123661.16	Solid Surfacing Countertops	Product Data

123661.16	Solid Surfacing Countertops	Shop Drawings
123661.16	Solid Surfacing Countertops	Sample
133419	Metal Building Systems	Product Data
133419	Metal Building Systems	Shop Drawings
220500	Common Work Results for Plumbing	Product Data
220523	General-Duty Valves for Plumbing Piping	Product Data
220529	Hangers and Supports for Plumbing Piping and Equipment	Product Data
220529	Hangers and Supports for Plumbing Piping and Equipment	Certification
220553	Identification for Plumbing Piping and Equipment	Product Data
220719	Plumbing Piping Insulation	Product Data
221116	Domestic Water Piping	Product Data
221119	Domestic Water Piping Specialties	Product Data
221119	Domestic Water Piping Specialties	Operation / Maintenance Manual
221123.21	Inline, Domestic-Water Pumps	Product Data
221123.21	Inline, Domestic-Water Pumps	Operation / Maintenance Manual
221316	Sanitary Waste And Vent Piping	Product Data
221319	Sanitary Waste Piping Specialties	Product Data
221319	Sanitary Waste Piping Specialties	Operation / Maintenance Manual
221319.13	Sanitary Drains	Product Data
221323	Sanitary Waste Interceptors	Product Data
221323	Sanitary Waste Interceptors	Operation / Maintenance Manual
223100	Domestic Water Softeners	Product Data
223100	Domestic Water Softeners	Shop Drawings
223100	Domestic Water Softeners	Operation / Maintenance Manual
223100	Domestic Water Softeners	Warranty
223400	Fuel-Fired, Domestic-Water Heaters	Product Data
223400	Fuel-Fired, Domestic-Water Heaters	Operation / Maintenance Manual
223400	Fuel-Fired, Domestic-Water Heaters	Warranty
224200	Commercial Plumbing Fixtures	Product Data
224200	Commercial Plumbing Fixtures	Warranty
224716	Pressure Water Coolers	Product Data
224716	Pressure Water Coolers	Operation / Maintenance Manual
230523	General-Duty Valves For HVAC Piping	Product Data
230529	Hangers And Supports For HVAC Piping And Equipment	Product Data
230553	Identification For HVAC Piping And Equipment	Product Data
230593	Testing, Adjusting, And Balancing For HVAC	Test Report
230713	Duct Insulation	Product Data
230719	HVAC Piping Insulation	Product Data
230923	Direct Digital Control (DDC) System For HVAC	Product Data
230923	Direct Digital Control (DDC) System For HVAC	Shop Drawings
230923	Direct Digital Control (DDC) System For HVAC	Certification
230923	Direct Digital Control (DDC) System For HVAC	Operation / Maintenance Manual
230923	Direct Digital Control (DDC) System For HVAC	Warranty
230923.12	Control Dampers	Product Data
231123	Facility Natural-Gas Piping	Product Data

232300	Refrigerant Piping	Product Data
233113	Metal Ducts	Product Data
233113	Metal Ducts	Shop Drawings
233300	Air Duct Accessories	Product Data
233300	Air Duct Accessories	Operation / Maintenance Manual
233346	Flexible Ducts	Product Data
233423	Hvac Power Ventilators	Product Data
233423	Hvac Power Ventilators	Shop Drawings
233423	Hvac Power Ventilators	Operation / Maintenance Manual
233713.13	Air Diffusers	Product Data
233713.23	Registers And Grilles	Product Data
235123	Gas Vents	Product Data
235123	Gas Vents	Certification
235123	Gas Vents	Warranty
233813	Commercial-Kitchen Hoods	Product Data
233813	Commercial-Kitchen Hoods	Shop Drawings
233813	Commercial-Kitchen Hoods	Operation / Maintenance Manual
233813	Commercial-Kitchen Hoods	Test Report
235416.13	Gas-Fired Furnaces	Product Data
235416.13	Gas-Fired Furnaces	Operation / Maintenance Manual
235416.13	Gas-Fired Furnaces	Warranty
235533.16	Gas-Fired Unit Heaters	Product Data
235533.16	Gas-Fired Unit Heaters	Operation / Maintenance Manual
235533.16	Gas-Fired Unit Heaters	Warranty
237223.23	Packaged, Outdoor, Heat Wheel Energy Recovery Units	Product Data
237223.23	Packaged, Outdoor, Heat Wheel Energy Recovery Units	Operation / Maintenance Manual
237223.23	Packaged, Outdoor, Heat Wheel Energy Recovery Units	Warranty
237416.11	Packaged, Small-Capacity, Rooftop Air-Conditioning Units	Product Data
237416.11	Packaged, Small-Capacity, Rooftop Air-Conditioning Units	Operation / Maintenance Manual
237416.11	Packaged, Small-Capacity, Rooftop Air-Conditioning Units	Warranty
237433	Dedicated Outdoor-Air Units	Product Data
237433	Dedicated Outdoor-Air Units	Operation / Maintenance Manual
237433	Dedicated Outdoor-Air Units	Warranty
23 8126	Split-System Air-Conditioners	Product Data
23 8126	Split-System Air-Conditioners	Operation / Maintenance Manual
23 8126	Split-System Air-Conditioners	Warranty
26 0519	Low-Voltage Electrical Power Conductors And Cables	Product Data
26 0526	Grounding And Bonding For Electrical Systems	Product Data
260526	Grounding And Bonding For Electrical Systems	Operation / Maintenance Manual
260529	Hangers And Supports For Electrical Systems	Product Data
260533	Raceways And Boxes For Electrical Systems	Product Data
260553	Identification For Electrical Systems	Product Data
260573.19	Arc-Flash Hazard Analysis	Product Data
260573.19	Arc-Flash Hazard Analysis	Test Report
260923	Lighting Control Devices	Product Data

260923	Lighting Control Devices	Operation / Maintenance Manual
260923	Lighting Control Devices	Warranty
262416	Panelboards	Product Data
262416	Panelboards	Shop Drawings
262416	Panelboards	Operation / Maintenance Manual
262416	Panelboards	Warranty
262726	Wiring Devices	Product Data
262816	Enclosed Switches And Circuit Breakers	Product Data
262816	Enclosed Switches And Circuit Breakers	Operation / Maintenance Manual
263600	Transfer Switches	Product Data
263600	Transfer Switches	Operation / Maintenance Manual
263600	Transfer Switches	Warranty
265000	Lighting	Product Data
265000	Lighting	Operation / Maintenance Manual
265000	Lighting	Warranty
284621.11	Addressable Fire-Alarm Systems	Product Data
284621.11	Addressable Fire-Alarm Systems	Operation / Maintenance Manual
284621.11	Addressable Fire-Alarm Systems	Warranty
311000	Site Clearing and Demolition	Operation / Maintenance Manual
311000	Site Clearing and Demolition	Construction Schedule
312000	Earth Moving	Product Data
312000	Earth Moving	Test Report
312500	Erosion Control	Operation / Maintenance Manual
321313	Concrete Pavement	Product Data
321313	Concrete Pavement	Test Report
321373	Concrete Paving Joint Sealants	Product Data
321373	Concrete Paving Joint Sealants	Certification
334100	Storm Utility Drainage Piping	Product Data

END OF SECTION 01 3300

SECTION 013513.28 - SITE SECURITY AND HEALTH REQUIREMENTS (MONG)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUBMITTALS

A. List of required submittals:

1. Materials Safety Data Sheets for all hazardous materials to be brought onsite.
2. Schedule of proposed shutdowns, if applicable.
3. A list of the names of all employees who will submit fingerprints for a background check, and the signed privacy documents identified below for each employee.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 ACCESS TO THE SITE

A. The Contractor shall arrange with Facility Representatives to establish procedures for the controlled entry of workers and materials into the work areas at the Facility.

B. The Contractor shall establish regular working hours with Facility Representatives. The Contractor must report changes in working hours or overtime to Facility Representatives and obtain approval twenty-four (24) hours ahead of time. The Contractor shall report emergency overtime to Facility Representatives as soon as it is evident that overtime is needed. The Contractor must obtain approval from Facility Representatives for all work performed after dark.

C. The Contractor shall provide the name and phone number of the Contractor’s employee or agent who is in charge onsite; this individual must be able to be contacted in case of emergency. The Contractor must be able to furnish names and address of all employees upon request.

D. All construction personnel shall visibly display issued identification cards.

3.2 FIRE PROTECTION, SAFETY, AND HEALTH CONTROLS

A. The Contractor shall take all necessary precautions to guard against and eliminate possible fire hazards.

1. Onsite burning is prohibited.
2. The Contractor shall store all flammable or hazardous materials in proper containers located outside the buildings or offsite, if possible.
3. The Contractor shall provide and maintain, in good order, during construction fire extinguishers as required by the National Fire Protection Association. In areas of flammable liquids, asphalt, or electrical hazards, 15-pound carbon dioxide or 20-pound

dry chemical extinguishers shall be provided.

B. The Contractor shall not obstruct streets or walks without permission from the Owner's Construction Representative and Facility Representatives.

C. The Contractor's personnel shall not exceed the speed limit of 15 mph while at the Facility unless otherwise posted.

D. The Contractor shall take all necessary, reasonable measures to reduce air and water pollution by any material or equipment used during construction. The Contractor shall keep volatile wastes in covered containers, and shall not dispose of volatile wastes or oils in storm or sanitary drains.

E. The Contractor shall keep the project site neat, orderly, and in a safe condition at all times. The Contractor shall immediately remove all hazardous waste, and shall not allow rubbish to accumulate. The Contractor shall provide onsite containers for collection of rubbish and shall dispose of it at frequent intervals during the progress of the Work.

F. Fire exits, alarm systems, and sprinkler systems shall remain fully operational at all times, unless written approval is received from the Owner's Construction Representative and the appropriate Facility Representative at least twenty-four (24) hours in advance. The Contractor shall submit a written time schedule for any proposed shutdowns.

G. For all hazardous materials brought onsite, Material Safety Data Sheets shall be on site and readily available upon request at least a day before delivery.

H. Alcoholic beverages or illegal substances shall not be brought upon the Facility premises. The Contractor's workers shall not be under the influence of any intoxicating substances while on the Facility premises.

3.3 SECURITY CLEARANCES AND RESTRICTIONS

A. FMDC REQUIRED FINGERPRINTING FOR CRIMINAL BACKGROUND AND WARRANTS CHECK

1. All employees of the Contractor are required to submit fingerprints to the Missouri State Highway Patrol to enable the Office of Administration, Division of Facilities Management, Design and Construction (FMDC) to receive state and national criminal background checks on such employees. FMDC reserves the right to prohibit any employee of the Contractor from performing work in or on the premises of any facility owned, operated, or utilized by the State of Missouri for any reason.
2. The Contractor shall ensure all of its employees submit fingerprints to the Missouri State Highway Patrol and pay for the cost of such background checks. The Contractor shall submit to FMDC via email to FMDCSecurity@oa.mo.gov a list of the names of the Contractor's employees who will be fingerprinted and a signed Missouri Applicant Fingerprint Privacy Notice, Applicant Privacy Rights and Privacy Act Statement for each employee. All employees of the Contractor approved by FMDC to work at a State facility must obtain a contractor ID badge from FMDC prior to beginning work on-site, unless the Director of FMDC, at the Director's discretion, waives the requirement for a contractor ID badge. The Contractor and its employees must comply with the process for background checks and contractor ID badges found on FMDC's website at: https://oa.mo.gov/fmdc-contractor-id-badges.
3. Pursuant to section 43.540, RSMo, FMDC participates in the Missouri Rap Back and National Rap Back programs as of August 28, 2018. This means that the Missouri State

Highway Patrol, Central Records Repository, and the Federal Bureau of Investigation will retain the fingerprints submitted by each of the Contractor's employees, and those fingerprints will be searched against other fingerprints on file, including latent fingerprints. While retained, an employee's fingerprints may continue to be compared against other fingerprints submitted or retained by the Federal Bureau of Investigation, including latent fingerprints.

4. As part of the Missouri and National Rap Back programs, FMDC will receive notification if a new arrest is reported for an employee whose fingerprints have been submitted for FMDC after August 28, 2018. If the employee is performing work on a State contract at the time of the arrest notification, FMDC will request and receive the employee's updated criminal history records. If the employee is no longer performing work on a State contract, FMDC will not obtain updated criminal records.
5. Pursuant to section 43.540, RSMo, the Missouri State Highway Patrol will provide the results of the employee's background check directly to FMDC. FMDC may NOT release the results of a background check to the Contractor or provide the Contractor any information obtained from a background check, either verbally or in writing. FMDC will notify the Contractor only whether an employee is approved to work on State property.
6. Each employee who submits fingerprints to the Missouri State Highway Patrol has a right to obtain a copy of the results of his or her background check. The employee may challenge the accuracy and completeness of the information contained in a background check report and obtain a determination from the Missouri State Highway Patrol and/or the FBI regarding the validity of such challenge prior to FMDC making a final decision about his or her eligibility to perform work under a State contract.
7. The Contractor shall notify FMDC via email to FMDCSecurity@oa.mo.gov if an employee is terminated or resigns from employment with the Contractor. If the Contractor does not anticipate performing work on a State contract in the future, the Contractor may request that FMDC remove its employees from the Rap Back programs. However, if removed from the Rap Back programs, employees will be required to submit new fingerprints should the contractor be awarded another State contract.
8. Upon award of a Contract, the Contractor should contact FMDC at FMDCSecurity@oa.mo.gov to determine if its employees need to provide a new background check. If a Contractor's employee has previously submitted a fingerprint background check to FMDC as part of the Missouri and National Rap Back programs, the employee may not need to submit another fingerprint search for a period of three to six years, depending upon the circumstances. The Contractor understands and agrees that FMDC may require more frequent background checks without providing any explanation to the Contractor. The fact that an additional background check is requested by FMDC does not indicate that the employee has a criminal record.

3.4 DISRUPTION OF UTILITIES

A. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and the Facility Representative before disconnecting electric, gas, water, fire protection, or sewer service to any building.

B. The Contractor shall give a minimum of seventy-two (72) hours written notice to the Construction Representative and Facility Representative before closing any access drives, and shall make temporary access available, if possible. The Contractor shall not obstruct streets, walks, or parking.

3.5 PROTECTION OF PERSONS AND PROPERTY

A. SAFETY PRECAUTIONS AND PROGRAMS

1. The Contractor shall at all times conduct operations under this Contract in a manner to avoid the risk of bodily harm to persons or risk of damage to any property. The Contractor shall promptly take precautions which are necessary and adequate against conditions created during the progress of the Contractor's activities hereunder which involve a risk of bodily harm to persons or a risk of damage to property. The Contractor shall continuously inspect Work, materials, and equipment to discover and determine any such conditions and shall be solely responsible for discovery, determination, and correction of any such conditions. The Contractor shall comply with applicable safety laws, standards, codes, and regulations in the jurisdiction where the Work is being performed, specifically, but without limiting the generality of the foregoing, with rules regulations, and standards adopted pursuant to the Williams-Steiger Occupational Safety and Health Act of 1970 and applicable amendments.
2. All contractors, subcontractors and workers on this project are subject to the Construction Safety Training provisions 292.675 RSMo.
3. In the event the Contractor encounters on the site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), lead, mercury, or other material known to be hazardous, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner's Representative and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner's Representative and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless by written agreement of the Owner's Representative and the Contractor. “Rendered Harmless” shall mean that levels of such materials are less than any applicable exposure standards, including but limited to OSHA regulations.

B. SAFETY OF PERSONS AND PROPERTY

1. The Contractor shall take reasonable precautions for safety of, and shall provide protection to prevent damage, injury, or loss to:

    a. clients, staff, the public, construction personnel, and other persons who may be affected thereby;
    b. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or the Contractor's Subcontractors of any tier; and
    c. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

2. The Contractor shall give notices and comply with applicable laws, standards, codes, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury, or loss.
3. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, safeguards for safety and protection, including, but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.
4. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.
5. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in this Section caused in whole or in part by the Contractor, a Subcontractor of any tier, or anyone directly or indirectly employed by any of them, or by anyone for whose

acts they may be liable, and for which the Contractor is responsible under this Section, except damage or loss attributable solely to acts or omissions of Owner or the Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's other obligations stated elsewhere in the Contract.

6. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, and the maintaining, enforcing and supervising of safety precautions and programs. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner's Representative and Architect. The Contractor shall hold regularly scheduled safety meetings to instruct Contractor personnel on safety practices, accident avoidance and prevention, and the Project Safety Program. The Contractor shall furnish safety equipment and enforce the use of such equipment by its employees and its subcontractors of any tier.
7. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
8. The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, lost time injury, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages are caused, the accident shall be reported immediately.
9. The Contractor shall promptly notify in writing to the Owner of any claims for injury or damage to personal property related to the work, either by or against the Contractor.
10. The Owner assumes no responsibility or liability for the physical condition or safety of the Work site or any improvements located on the Work site. The Contractor shall be solely responsible for providing a safe place for the performance of the Work. The Owner shall not be required to make any adjustment in either the Contract Sum or Contract Time concerning any failure by the Contractor or any Subcontractor to comply with the requirements of this Paragraph.
11. In no event shall the Owner have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents.
12. The Contractor shall maintain at his own cost and expense, adequate, safe and sufficient walkways, platforms, scaffolds, ladders, hoists and all necessary, proper, and adequate equipment, apparatus, and appliances useful in carrying on the Work and which are necessary to make the place of Work safe and free from avoidable danger for clients, staff, the public and construction personnel, and as may be required by safety provisions of applicable laws, ordinances, rules regulations and building and construction codes.

END OF SECTION 013513.28

SECTION 01 5000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for construction facilities and temporary controls including temporary utilities, support facilities, security, and protection.

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution
2. Temporary electric power and light
3. Temporary heat
4. Ventilation
5. Telephone service
6. Sanitary facilities, including drinking water
7. Storm and sanitary sewer

C. Support facilities include, but are not limited to, the following:

1. Field offices and storage sheds
2. **Temporary portable restroom trailer (for Owner's use only)**
3. Temporary roads and paving
4. Dewatering facilities and drains
5. Temporary enclosures
6. Hoists and temporary elevator use
7. Temporary project identification signs and bulletin boards
8. Waste disposal services
9. Rodent and pest control
10. Construction aids and miscellaneous services and facilities

D. Security and protection facilities include, but are not limited to, to following:

1. Temporary fire protection
2. Barricades, warning signs, and lights
3. Sidewalk bridge or enclosure fence for the site
4. Environmental protection

1.3 SUBMITTALS

A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Temporary Portable Restroom Trailer: Submit floor plan layout; mechanical, electrical and plumbing systems; parking requirements; utility requirements.

C. Implementation and Termination Schedule: Within (15) days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations including, but not limited to, the following:

1. Building code requirements
2. Health and safety regulations
3. Utility company regulations
4. Police, fire department, and rescue squad rules
5. Environmental protection regulations

B. Standards: Comply with NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”. ANSI A10 Series standards for “Safety Requirements for Construction and Demolition”, and NECA Electrical Design Library “Temporary Electrical Facilities”.

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code”.

C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist onsite.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. If acceptable to the Designer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Division 6 Section “Rough Carpentry”.

1. For job-built temporary office, shops, and sheds within the construction area, provide UL-labeled, fire-treated lumber and plywood for framing, sheathing, and siding.
2. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sized and thicknesses indicated.

3. For fences and vision barriers, provide minimum 3/9" (9.5mm) thick exterior plywood.
4. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" (16mm) thick exterior plywood.

C. Gypsum Wallboard: Provide gypsum wallboard on interior walls of temporary offices.

D. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary office, shops, and shed.

E. Paint: Comply with requirements of Division 9 Section "Painting".

1. For job-built temporary offices, shops, sheds, fences, and other exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
2. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
3. For interior walls of temporary offices, provide two (2) quarts interior latex-flat wall paint.

F. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of (15) or less. For temporary enclosures, provide translucent, nylon-reinforced laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.

G. Water: Provide potable water approved by local health authorities.

H. Open-Mesh Fencing: Provide 0.120" (3mm) thick, galvanized 2" (50mm) chainlink fabric fencing 6' (2m) high with galvanized steel pipe posts, 1½" (38mm) ID for line posts and 2½" (64mm) ID for corner posts.

2.2 EQUIPMENT

A. General: Provide new equipment. If acceptable to the Designer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

B. Water Hoses: Provide ¾" (19mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100' (30m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110 to 120V plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage rating.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixture where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

H. Temporary Portable Restroom Trailer FOR OWNER'S USE ONLY: Provide fully self-contained ADA compliant trailer, with the following:

1. Hydraulic trailer lowering system
2. ADA accessible landing/ramp system
3. (1) ADA accessible non-gender room with lavatory
4. Women's restroom with minimum of (2) toilet stalls and (1) lavatory
5. Men's restroom with minimum of (1) toilet stall, (1) urinal and (1) lavatory
6. Self closing faucets
7. Built-in toilet accessories: grab bars, soap dispensers, paper towel dispensers, toilet paper dispensers, shatter-proof mirrors, waster receptacle
8. Smooth finish interiors for easy clean
9. Roof mounted A/C unit with heat strip and wall mounted thermostat
10. LED lighting
11. On-board fresh water system with water pumps, electric water heater, water distribution system.
12. Waste tank with 3/8 thick walls, quick connect access valve, and sight glass level indicator
13. Pump services twice per week
14. Cleaning service one time per week.
15. Location: refer to civil Site Plan

I. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers, or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each Facility ready for use when needed to avoid delay. Maintain and modify as required. 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: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.

2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Designer. Neither the Owner nor Designer will accept cost or use charges as a basis of claims for Change Order.

B. Temporary Water Service: The Owner will provide water for construction purposes from the existing building system. All required temporary extensions shall be provided and removed by the Contractor. Connection points and methods of connection shall be designated and approved by the Construction Representative.

C. Temporary Electric Power Service: The Owner will provide electric power for construction lighting and power tools. Contractors using such services shall pay all costs of temporary services, circuits, outlet, extensions, etc.

D. Temporary Lighting: provide temporary lighting with local switching.

1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.

E. Temporary Heating and Cooling: The normal heating and/or cooling system of the building shall be maintained in operation during the construction. Should the Contractor find it necessary to interrupt the normal HVAC service to spaces, which have not been vacated for construction, such interruptions shall be pre-scheduled with the Construction Representative.

F. Temporary Telephones: Provide cell phone service throughout the construction period for all personnel engaged in construction activities.

1. Post a list of important telephone numbers.

G. Temporary Restroom Trailer (For Owner's Use only): Install self-contained restroom trailer per suppliers requirements. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs and as indicated on the Drawings.

H. Temporary Toilets: Use of the Owner's existing toilet facilities will not be permitted. Provide portable self-contained toilet and wash facilities to be used by Contractor.

I. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a health and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

1. Provide paper towels or similar disposable materials for each facility.
2. Provide covered waste containers for used material.
3. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

J. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.

1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45°F to 55°F (7°C to 13°C).

K. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip office as follows:

1. Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase.
2. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.

C. Temporary Portable Restroom Trailer FOR OWNER'S USE ONLY: Provide self-contained unit of sufficient size to accommodate Owner. Locate the unit per the civil engineering site plan and provide required utilities. Keep the trailer clean.

1. This restroom trailer must be available for Owner's use throughout the duration of construction, until the Owner can occupy and utilize the newly renovated toilet facilities within the building.

2. The restroom trailer will not be available for Contractor use.

D. Storage facilities: Install storage sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere onsite.

E. Storage Facilities: Limited areas for storage of building materials are available onsite. Available storage areas are shown on the drawings. The Contractor shall provide his own security. Specific locations for storage and craning operations will be discussed at the Pre-Bid Meeting and the Pre-Construction Meeting.

F. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Designer.

1. Paving: Comply with Division 2 Section "Hot-Mixed Asphalt Paving" for construction and maintenance of temporary paving.
2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.

G. Construction Parking: Parking at the site will be provided in the areas designated at the Pre-Construction Meeting.

H. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and materials drying or curing requirements to avoid dangerous conditions and effects.
2. Install tarpaulins securely with incombustible wood framing and other materials. Close openings of 25SqFt (2.3SqM) or less with plywood or similar materials.
3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Where temporary wood or plywood enclosure exceeds 100SqFt (9.2SqM) in area, use UL-labeled, fire-retardant-treated material for framing and main sheathing.

J. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

K. Project Identification and Temporary Signs: Prepare project identification and other signs of size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood or steel. Do not permit installation of unauthorized signs.

1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.

L. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.

M. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

N. Rodent Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Employ this service to perform extermination and control procedures are regular intervals so the Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Designer.

B. Temporary Fire Protection: install and maintain fire-protection facilities of the types needed to protect against reasonable predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations”.

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.

D. Enclosure Fence: Before excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth.

E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

1. Storage: Where materials and equipment must be stored and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

F. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

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.
2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Unless the Designer requests that it be maintained longer, remove each temporary facility when the need has ended, when 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 the 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 the Contractor's property. The Owner reserves the right to take possession of project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. 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 the temporary entrances as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

    a. Replace air filters and clean inside of ductwork and housing.
    b. Replace significantly worn parts and parts subject to unusual operating conditions.
    c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION 01 5000

SECTION 017400 – CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions, Bid Form, and other Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for cleaning during the Project.

B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.

1. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator for the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General

1. Retain all stored items in an orderly arrangement allowing maximum access, not impending drainage or traffic, and providing the required protection of materials.
2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the jobsite.
4. Provide adequate storage for all items awaiting removal from the jobsite, observing all requirements for fire protection and protection of the ecology.

B. Site

1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

2. Weekly, inspect all arrangements of materials stored onsite. Re-stack, tidy, or otherwise service all material arrangements.

3. Maintain the site in a neat and orderly condition at all times.

C. Structures

1. Daily, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

2. Weekly, sweep all interior spaces clean. “Clean” for the purposes of this paragraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.

3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.

4. Following the installation of finish floor materials, clean the finish floor daily while work is being performed in the space in which finish materials have been installed. “Clean” for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish floor material.

5. Portable Restroom Trailer: Weekly, clean and sanitize the portable restroom trailer. “Clean” for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material and biohazardous waste.

3.2 FINAL CLEANING

A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer’s instructions.

B. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.

1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities including landscape development areas, of rubbish, waste material, litter, and foreign substances.

2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

3. Remove petrochemical spills, stains, and other foreign deposits.

4. Remove tools, construction equipment, machinery, and surplus material from the site.

5. Remove snow and ice to provide safe access to the building.
6. 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.
7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
8. Broom clean concrete floors in unoccupied spaces.
9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.
10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
11. Remove labels that are not permanent labels.
12. 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.
a. Do not paint over “UL” and similar labels, including mechanical and electrical nameplates.
13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.
15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
16. Clean ducts, blowers, and coils if units were operated without filters during construction
17. Clean food-service equipment to a sanitary condition, ready and acceptable for its intended use.
18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
19. Leave the Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection

and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.

D. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.

E. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.

1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner's property.

END OF SECTION 017400

SECTION 017900 - DEMONSTRATION AND TRAINING

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 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.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and 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.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 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.
d. Name of Construction Manager.
e. Name of Contractor.
f. 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.

1.5 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.

B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "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.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

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 each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following 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 training manual organized in coordination with requirements in Section 007213 "General Conditions".

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

C. 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.

D. Cleanup: Collect used and leftover educational materials and remove from Project site. 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.
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

SECTION 02 82 00 –ASBESTOS REMEDIATION

PART 1 - GENERAL

1.1 PROJECT/WORK IDENTIFICATION

A. General: The work specified herein shall be the abatement of asbestos containing materials by certified and registered persons who are knowledgeable, qualified and trained in the abatement, handling, and disposal of asbestos containing material, and subsequent cleaning of the affected environment.

B. The contractor shall supply all labor, materials, equipment, testing, services, permits, notifications, insurance and incidentals which are necessary or required to perform the work in accordance with applicable local, state and federal regulations as may be necessary for the abatement of asbestos containing materials and for other work as specified in this section or as indicated in associated drawings, sketches, or details of the work.

C. Scope of Work:

Abate/remove asbestos containing materials identified in the inspection report.

D. All asbestos abatement work areas must pass visual inspection as well as final clearance air-monitoring (by independent TPAM)

1.2 LIST OF MATERIALS CONTAINING ASBESTOS (TO BE ABATED)

Material	Location	Asbestos Content	Total Quantity
Safe Door	Ordnance Room	60% Chrysotile	1 each
12x12 Beige Floor Tile and Adhesive (under carpet)	Offices 326, 157, 158, 219	2% Chrysotile in Floor Tile; 3% Chrysotile in Mastic	860 square feet
Associated Mastic Adhesive under VCT	Offices 405 and 453	2-3% Chrysotile in Mastic	858 square feet
9x9 Brown Floor Tile and Adhesive	Office 453, Mechanical Room	6% Chrysotile in Floor Tile; 4% Chrysotile in Mastic	4 square feet
12x12 Beige Floor tile and Adhesive	Kitchen	2% Chrysotile in Floor Tile; 3% Chrysotile in Mastic	177 square feet
Pipe Insulation	Abandoned Water Line	55% Chrysotile	150 linear feet

Contractor is responsible for verifying all materials and quantities identified above prior to submitting their bid. The Asbestos report is included as an appendix to the specifications. The survey and specification are based on the demolition plans provided.

1.3 TERMINOLOGY/DEFINITIONS/ABBREVIATIONS

A. Definitions:

1. Abatement: The Encapsulation, Enclosure and/or Removal of Asbestos Containing Materials (ACM). For Category I Non-friable ACM which will remain non-friable throughout disposal abatement procedures will be modified and simplified as found within these and other applicable regulations.
2. Adequately Wet: To sufficiently mix or penetrate with liquid to prevent the release of particulates.
3. AHERA: Asbestos Hazard Emergency Response Act of 1966 (P.L. 99-519).
4. Aggressive Air Sampling: Sweeping of floors, ceilings and walls and other surfaces with the exhaust of a minimum of one (1) horsepower leaf blower or equivalent immediately prior to air monitoring.
5. Air Sampling Professional: An individual, certified by the State of Missouri, who supervises air sampling activities during asbestos abatement projects.
6. Air Sampling Technician: An individual, under the supervision of an Air Sampling Professional, who performs air sampling during asbestos abatement projects.
7. Asbestos: The asbestiform varieties of serpentinite (chrysotile, antigorite), riebeckite (crocidolite), cummintonite-grumerite (amosite), anthophyllite and actinolite-tremolite. For purposes of determining respiratory and worker protection both the asbestiform and non-asbestiform varieties of the above materials and any of these materials that have been chemically treated and/or altered shall be considered as asbestos.
8. Asbestos Abatement Project Designer: An individual, certified by the State of Missouri, who prepares asbestos abatement project designs, primarily associated with AHERA-related projects.
9. Asbestos Abatement Supervisor: An individual, certified by the State of Missouri, who directs, controls, and/or supervises workers during an asbestos abatement project.
10. Asbestos Abatement Worker: An individual, certified by the State of Missouri, who performs asbestos abatement.
11. Asbestos-Containing Material (ACM): Any material or product which contains more than 1 percent (1%) asbestos by weight as determined by using the Polarized Light Microscopy method.
12. Asbestos-Containing Building Material (ACBM): Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on building components.
13. Asbestos Containing Building Material (ACBM) Repair: T he restoration of ACBM to an undamaged condition or to an intact state so as to prevent fiber release
14. Asbestos-Containing Waste Material (ACWM): Any material to be removed from a work area for disposal that is an asbestos containing material (ACM) or is suspected of being contaminated with ACM.
15. Barrier: Any surface that seals off the work area to inhibit the movement of asbestos fibers.
16. Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.
17. Category I Non-friable ACM: Asbestos-containing packings, gaskets, resilient floor covering and asphalt roofing products containing more than one percent (1%) asbestos as determined using the method specified in 40 CFR part 763, subpart F, Appendix A, section 1, Polarized Light Microscopy.
18. Category II Non-friable ACM: Any material, excluding category I non-friable ACM, containing more than one percent (1%) asbestos as determined using the methods specified in 40 CFR part 768, subpart F, Appendix A, section 1, Polarized Light Microscopy that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.
19. Certified Industrial Hygienist (C.I.H.): An industrial hygienist, certified in Comprehensive Practice by the American Board of Industrial Hygiene.
20. Competent Person: An individual, capable of identifying existing asbestos hazards in the workplace and who has authority to take prompt corrective measures to eliminate them. His duties include: establishing the negative-pressure enclosure, ensuring its integrity, and controlling entry to and exit from the enclosure; supervising any employee exposure monitoring; ensuring that all employees working within such an enclosure wear the appropriate personal protective equipment, are trained in the use of appropriate methods of exposure control, and in the use of hygiene facilities and decontamination procedures;

and ensuring that engineering controls in use are in proper operating condition and are functioning properly. An individual who has been certified by the State of Missouri as an Asbestos Abatement Supervisor is considered a "Competent Person".

21. Construction Administrator: An employee of the Division of Design an Construction representing the Director during the construction phase of the contract commencing at Notice of Award.
22. Containment: Area where asbestos abatement project is conducted. Area must be enclosed either by a glove bag or plastic sheeting barriers.
23. Critical Barrier: Plastic sheeting or other material to be placed over Work Area openings (i.e., windows, HVAC supply and return vents, doors, electrical fixtures, etc.).
24. Decontamination Facility: The serial arrangement of rooms or spaces for the purpose of separating the work site from the building environment upon entering the Work Area and for the cleaning of persons, equipment and contained waste prior to returning to the clean environment.
25. Disposal Bag: A properly labeled 6 mil. thick leak-tight clear plastic bag used for transporting asbestos waste from work site and to the disposal site.
26. Encapsulant (Sealant): A liquid material which can be applied to asbestos-containing material and which prevents the release of asbestos fibers from the ACM either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the ACM and binding its components together (penetrating encapsulant) or is specifically designed to minimize fiber release during removal of ACM (removal encapsulant).
27. Encapsulation: Treatment of asbestos-containing materials with an encapsulant.
28. Enclosure: The construction of an airtight, impact resistant barrier to isolate a surface coated with ACM.
29. Friable: Any material which when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.
30. Glove Bag: A manufactured or fabricated device, typically constructed of six (6) mil transparent polyethylene or polyvinyl chloride plastic. This device consists of two (2) inward projecting long sleeves, an internal tool pouch and an attached, labeled receptacle for asbestos waste.
31. Initial Exposure Assessment: Is a required assessment to be performed by the Contractor's Competent Person (Asbestos Abatement Supervisor) concerning the exposure potential of a specific asbestos projects, or series of similar asbestos projects. If it is concluded that the employee exposures during the project are likely to be consistently below the Permissible Exposure Limit, the Contractor establishes a Negative Initial Exposure Assessment.
32. Outside Air: Air outside containment.
33. Permissible Exposure Limit (PEL): Eight-hour time weighted average of 0.1 fibers/cubic centimeter.
34. Personal Monitoring: Sampling of the asbestos fiber concentrations within the Breathing Zone.
35. Regulated Asbestos-Containing Material (RACM): Friable asbestos material; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; or Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.
36. Removal: To take out or eliminate ACM from building components, materials, substrates.
37. Third Party Air Monitor (TPAM): The Air Sampling Professional who conducts air monitoring in who is not under the direct control of the abatement contractor and who has been selected by the owner.
38. Visible Emission: Any discharge of an air contaminant into the atmosphere that is visually detectable without the aid of instruments.
39. Work Area: A specific room or physically isolated portion of a room, other than the space enclosed within a glove bag, in which friable asbestos-containing material is required to be handled in accordance with current federal and state regulations. The area is designated as a work area from the time that the room, or portion of it, is secured and access restrictions

are in place. The area remains designated as a work area until the time that it has been cleaned in accordance with any requirements applicable to the operations conducted.

B. Abbreviations:

1. AIA: American Institute of Architects
2. AIHA: American Industrial Hygiene Association
3. MoDNR: Missouri Department of Natural Resources
4. DEQ: Division of Environmental Quality, MoDNR
5. DOT: U. S. Department of Transportation
6. EPA: U. S. Environmental Protection Agency
7. MDH: Missouri Department of Health
8. NIOSH: National Institute for Occupational Safety and Health
9. NVLAP: National Voluntary Laboratory Accreditation Program
10. OSHA: Occupational Safety and Health Administration, U. S. Department of Labor.
11. SLCDOH: St. Louis County Department of Health
12. TPAM: Third Party Air Monitor

1.4 SUMMARY OF REQUIREMENTS

A. All work performed on this project shall be done in the strictest accordance with applicable federal, state and local regulations, standards and codes governing asbestos abatement and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.

B. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among requirements or these specifications exists, the most stringent requirements shall be utilized.

C. Because asbestos exposure is a serious health hazard, construction work involving any asbestos-containing materials is regulated by the Occupational Safety and Health Administration Regulations. Compliance with OSHA regulations in the completion of this project is the **sole** responsibility of the contractor. OSHA regulations include, but are not limited to, conducting appropriate negative exposure assessments and/or daily personnel air monitoring. However, the following requirements will apply regardless of the removal methods to be employed:

a. Regardless of the removal methods employed, the contractor shall immediately stop work in the event of any of the following:

1) Visible Emissions (as defined in this document), or
2) Sanding, grinding, cutting abrading, removal by open flame, or
3) Breathing Zone air samples exceed the PEL or Excursion Limit; furthermore, the contractor shall implement corrective work practices upon the approval of the Asbestos Abatement Project Designer, make re-notification to all regulatory agencies of the changes in work practices and material conditions, and comply with all referenced regulations in this document and the applicable sections of this specification as noted.

b. If any of the conditions in subparagraph a above are observed by the Construction Administrator or by the Third-Party Air Monitor (TPAM), then either of these parties has the right to issue a directive to stop work. The Contractor shall be obligated to implement corrective action. The contractor shall not be entitled to additional compensation.

D. FRIABLE AND NON-FRIABLE ACM. This scope of work includes the removal of Friable and Non-friable ACM and therefore, all applicable federal, state, and local requirements, including notifications, should be followed.

1. Make notifications in compliance with Section 2.1 of this specification.
2. Remove and dispose of all friable and non-friable asbestos containing materials in compliance with the federal and state regulations as listed, but not necessarily limited to, those under section 3.0 of this specification.

1.5 PROJECT COORDINATION

A. Contractor shall coordinate and schedule all phases of the work of the contract documents under his control with the Construction Administrator, Facility Representative, any subcontractors, materials suppliers and other parties involved as necessary to ensure the smooth and orderly transition of separate phases, timely placement of items and materials, cooperation between parties, and proper execution of the work. **Contractor must give the TPAM at least two business days' notice of start of work or change of work schedule. The contractor will be required to reimburse the State of Missouri for hours TPAM worked and for their expenses if the TPAM mobilizes and abatement work has been canceled, delayed, or postponed for that day.**

B. All coordination necessary with the facility will be made through the Facility Representative or their designated representative. The Construction Administrator and Facility Representative prior to the start of any work, will approve scheduling, and access to the work areas.

C. Normal working hours of the facility will be observed in performing the work unless the Facility Representative and Construction Administrator approve the modification as addressed in the Special Conditions.

D. Contractor shall coordinate any news media inquiries or releases with the Facilities Management Design and Construction Division at (573) 751-3339.

E. The contractor, project superintendent, subcontractors and other appropriate parties shall attend meetings as scheduled and as otherwise necessary to accomplish the work in a timely and efficient manner. Meetings shall include but are not limited to the following:

1. Pre-Construction Meeting: the Construction Administrator will schedule the pre-construction meeting after the Notice of Award has been issued. The Construction Administrator will determine the date, time, and exact place of this meeting and all necessary parties will be notified. During the meeting, discussions will be held in regard to construction procedures, scheduling requirements, general conditions, special conditions, channels of communication, responsible persons, requirement's for submittals, documentation requirements, payment applications and other pertinent information necessary for completing the work. Specific requirements of the facility in regard to security, safety, utilities, access to buildings and related matters will also be discussed.

2. If, in the opinion of the Construction Administrator, additional meetings are required to maintain progress or scheduling requirements on the work, additional meetings will be scheduled.

F. All fees required for notification requirements, re-notifications, and/or inspections by the Department of Natural Resources and all other federal, state, or local agencies shall be paid by the contractor. If necessary, bulk samples analysis information required in conjunction with the notification to the Missouri Department of Natural Resources, U. S. Environmental Protection Agency or city having jurisdiction shall be provided by the contractor unless provided within this specification.

G. Should the project fall behind schedule, the abatement contractor is expected to take such steps, as necessary, to complete the project on time. The contractor will be entitled to no additional compensation for implementation of such steps to maintain the work schedule.

PART 2 - EXECUTION

2.1 NOTIFICATIONS

A. Based on the fact that material being removed amounts to more than 260 LF, 160 SF or 35 cubic feet or if abatement is being done prior to a demolition, Notification shall be completed and sent by the contractor not less than ten (10) days before the intended starting date of the project. For amounts less than the above, contractor shall send a courtesy Notification. Use EPA form "Notification of Demolition and Renovation", and the MoDNR form "Asbestos Project Notification", to the following:

1. Department of Natural Resources
   Air Pollution Control Program (ASBESTOS)
   P. O. Box 176
   Jefferson City, MO 65102

2. Provide copies of these notifications to the state's independent oversight consultant and the Construction Administrator.

B. A Post-Notification report shall be completed and sent by the Contractor to the agencies listed in 2.1A above within forty-five (45) days of the completion of the project. The MoDNR form "Asbestos Post Notification" is to be used for that purpose.

2.2 SUBMITTALS

A. The following submittals will be required of the contractor prior to commencement of work and are subject to approval by the Construction Administrator. The contractor shall send one copy of the submittals for approval and then send approved copies of the submittals to the distribution list as discussed at the Pre-Construction Conference.

1. Copy of Safety Data Sheets (SDS) for each product to be used by the contractor in the performance of his work. Contractor will also maintain copies of the SDS on-site, per OSHA.
2. A copy of the notifications to regulatory agencies as required in Section 2.1 of this specification.
3. Current training certificates and MoDNR licenses for project superintendent, asbestos abatement supervisor(s) and asbestos workers. Superintendent shall meet the qualifications established in Section 3.8 of these specifications. EPA RRP training certificates shall also be provided.
4. Name, address and contact person's name of testing laboratory or laboratories to be utilized by the contractor (this is <u>not</u> the TPAM) in analyzing samples for bulk analysis or air monitoring. Required by OSHA.
5. Provide a detailed work schedule with milestones for the completion of the project within the established timeframe.
6. Provide a disposal plan to detail the types of disposal containers to be used, the methods of transportation to the disposal site, the waste hauler and disposal site.
7. Copies of notifications required as part of the emergency notification plan in Section 2.6 of this specification.

B. Upon completion of the work and prior to final payment, the following information must be submitted to the Construction Administrator.

1. Waste disposal receipts and waste shipment record on all asbestos waste removed from the project. The enclosed Waste Shipment Record and Receipt form (or something similar) must be used for every load brought to the waste disposal site. The disposal and/or shipment record must include the following information:

    a. Work site name and address;
    b. Project Number;
    c. Owner's name and telephone;
    d. Operator's (Contractor's) name, address and telephone;
    e. Waste Disposal Site name, address and telephone;
    f. Name and address of responsible agency;
    g. Type of materials and quantity in cubic yards or tons;
    h. Name, address and phone number of transporter, and date of transport; and
    i. Name, address and phone number of Waste Disposal Site representative and date material was received.

2. Air monitoring test results from all air samples taken by the TPAM during abatement, to include area, in progress and personal tests. Results must be written in final report form.

3. Written certification from the TPAM as required in Section 2.7 of this specification.

4. MoDNR "Asbestos Post Notification" form, within forty-five (45) days of the completion of the project.

5. Any other specific requirements spelled out in the General Conditions.

2.3 TESTING LABORATORY

A. Testing laboratories utilized by the contractor for OSHA required sample analysis during the project shall meet the following minimum requirements:

1. For bulk sample analysis, the laboratory must be accredited by the National Voluntary Laboratory Accreditation Program for asbestos fiber analysis.
2. For air samples analyzed by Phase Contrast Microscopy, the laboratory must be accredited by the American Industrial Hygiene Association.
3. For air samples analyzed by Transmission Electron Microscopy, the laboratory must be accredited by the National Voluntary Laboratory Accreditation Program.
4. On-site analysis by Phase Contrast Microscopy, when applicable, shall be by an Air Sampling Technician or Air Sampling Professional who has completed a NIOSH 582 course or equivalent.
5. Neither the contractor, nor any of his principals, officers, or directors may have any financial or business interests in any laboratory utilized on this contract.

2.4 LOCAL AREA PROTECTION/SITE SECURITY

A. The contractor shall be responsible for all areas of the building used by him and/or subcontractors in the performance of the work. He shall exert full control over the actions of all employees and subcontractors with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner by these specifications.

B. The contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection, and shall require all persons in the work area to observe the same regulations as he requires his employees.

C. The contractor shall have control of site security during abatement operations in order to protect his work and equipment. He will have the owner's assistance in notifying building occupants of impending activity and enforcement of restricted access by owner's employees.

D. The contractor shall keep, as a minimum, two 10 lbs. type ABC fire extinguishers on-site at all times. One extinguisher will be maintained outside the work area and one inside the work area. The contractor's employees shall be trained in the use and operation of the extinguishers.

E. The contractor shall use as small an area as necessary for storage of supplies and equipment and shall keep such in a neat and orderly fashion.

F. Contractor is prohibited from entering portions of the building not required for completion of their scope of work.

G. The contractor shall maintain the work area free from rubbish, debris, and dirt and keep a clean safe work area. The contractor shall take measures to keep surfaces free from contamination or shall clean and lock down surfaces after work is done, protect with plastic sheeting and/or plywood during work, or remove from the work area. Trash must be removed daily and will not be allowed to accumulate.

H. Contractor is responsible for all damage to the structure other than that required for the removal of the ACMs. At the conclusion of the project, the contractor must repair such incidental damage including tape and glue residue, paint coatings and damage to surfaces, finishes and building components.

2.5 WORKER PROTECTION/TRAINING

A. The contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, a written respirator program, medical examinations, protective clothing, and equipment, and for maintaining medical records to comply with OSHA requirements.

B. The contractor shall be responsible for all testing and costs incurred for complying with the requirements of OSHA regulations for Personal Monitoring.

C. All workers are to be trained in the dangers inherent in handling asbestos, breathing asbestos dust, and in proper work procedures and personal and protective measures.

2.6 EMERGENCY PROTECTION PLAN

A. The contractor shall be responsible for developing a written site-specific Emergency Protection Plan and shall maintain this plan on-site. The plan shall include considerations for asbestos leakage from site, fire, explosion, toxic atmospheres, electrical hazards, slips, falls and heat related injury. All employees shall be instructed and trained in the procedures.

B. Emergency protection planning shall also include written notification of police, fire and medical personnel of the planned abatement activities, work schedule, and the layout of the work area, particularly barriers that may affect response capabilities.

2.7 THIRD PARTY AIR MONITORING

A. The Owner will contract with an Air Sampling Professional to perform the following minimum duties:

1. Review Contractor's work plan and provide his recommendations.

2. As a minimum, during abatement operations, at least three samples daily shall be collected outside the work area at locations of barriers separating the work areas from other portions of the building. One sample shall be required at the decontamination entrance to the area. Samples shall be analyzed by PCM. Any result above the OSHA PEL of 0.1 f/cc (8 hr TWA), or EL of 1.0 f/cc (30 min TWA) must be immediately reported to the Construction Administrator and cause operations to cease and corrective measures be taken.
3. Provide Construction Administrator with daily abatement reports describing amount and type of work done, regulatory concerns, notable air monitoring reports, etc.
4. A visual inspection of the work area will be conducted prior to clearance.
5. Certify that the contractor's procedures, methods, and practices were in full compliance with current federal or state regulations, using the Appendix A form "TPAM Statement of Compliance".

B. The TPAM must be independent from the abatement contractor.

2.8 SUPERINTENDENCE OF ABATEMENT

A. The contractor shall designate an abatement superintendent, who will serve as the contractor's representative on the project and will ensure that all work is performed in compliance with all applicable regulations and following minimum requirements:

1. The Abatement Superintendent must be certified as an Asbestos Abatement Supervisor and must have at least one-year full time experience in asbestos abatement work.
2. Shall be on-site whenever work is going on.
3. Maintain a daily log documenting project events, visitations/inspections, problems, and accidents.
4. Implement first aid, safety training, respiratory protection and ensure workers are trained in emergency procedures.
5. Conduct visual inspection of the work area prior to TPAM's final clearance inspection. This inspection shall be documented.
6. Supervise activities of any subcontractors of the contractor to ensure compliance with contract documents.
7. Duties shall include those for the "Competent Person" as defined in this specification.
8. Superintendent must have a cellular telephone when at the project site and the contact information for the supervisor provided to the construction manager and TPAM.

2.9 FINAL CLEARANCE REQUIREMENTS

A. All critical barriers and/or containment must remain in place until work area is cleared by TPAM and Construction Manager in accordance with this section.

B. The TPAM, in addition to the requirements listed in Section 2.7 TPAM, will collect samples outside the work area to determine the effectiveness of work practices and control measures used by the contractor to contain asbestos fibers inside the work area. The TPAM will determine the number, frequency and location of the samples.

C. Following the completion of the abatement work, the abatement superintendent shall notify the Construction Administrator. The superintendent shall then perform a visual inspection of the work area. If satisfactory, he shall contact the TPAM. The TPAM shall perform a visual inspection and final air monitoring for clearance if he/she feels the abatement has been completed.

D. Aggressive air sampling shall be performed by the TPAM in areas where floor tile will be abated. In-progress/area samples will be used as clearance samples where glove bag removal is performed.

E. All clearance samples will be analyzed, at a minimum, by the PCM (NIOSH 7400) method, unless specifically stated elsewhere within this specification. The TPAM shall take a minimum of 5 samples inside each affected work space (or one per room which ever is greater), 1 field blank and 1 sealed blank. The abatement shall be considered complete when the result of each of 5 inside clearance samples indicate airborne fiber (> 0.25 um dia. x 5 um L) concentrations are no greater than the PCM limit of quantitation of 0.01 f/cc of air. Test results should be made available to the contractor within 24 hours.

If the NIOSH 7400 PCM clearance sampling method fails, then the TEM method 7402 may be utilized to further evaluate the air sample(s) that exceed 0.01 f/cc. The TPAM will be responsible for determining if a failing PCM sample will be analyzed by TEM 7402.

F. Any work areas failing to meet the clearance requirements of this section shall be re-cleaned and re-tested at the contractor's expense until satisfactory levels are obtained. The owner will not reimburse the contractor for re-cleaning the work area.

2.10 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS (Asbestos)

A. Re-establishment of the work area shall only occur after the contractor has complied with the clearance requirements of Section 2.9. All barriers, signs, trash, and equipment shall then be removed from the site. All electrical and HVAC systems shall be re-established.

B. All damage to finishes, equipment, and/or the area affected by the abatement shall be repaired by the contractor to equal or better condition as was prior to the work, at no cost to the owner.

2.11 WASTE DISPOSAL

A. All Asbestos Containing Waste Material (ACWM) shall be disposed of in compliance with current federal and state regulations.

B. ACM shall be disposed of in a Missouri licensed demolition landfill or a sanitary landfill having a state permit to operate and accept such waste.

C. A chain of custody letter/waste shipment record and disposal receipts shall be provided to the owner for all materials disposed of.

D. The waste shipment record shall be originated and signed by the waste generator and shall be used to track and substantiate the disposition of ACM.

2.12 DRAWINGS

A. For the purpose of this specification, drawings, when provided, are not intended to be used for anything other than a “reference” to the work area. Information is not specific to quantities or to the exact location of ACM. The contractor is required to field verify the conditions, locations and quantities referenced.

3.0 CODES AND REGULATIONS

A. This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of this specification.

B. Requirements include adherence to work practices and procedures set forth in applicable codes, regulations and standards.

C. General Applicability of Codes, Regulations and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations standards, statutes, laws and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith. In the event of conflicting applicable codes, regulations, standards, statutes, laws, or rules, the more stringent shall apply to these specifications.

D. Contractor Responsibility: The contractor shall assume full responsibility and liability for compliance with all applicable federal, state and local regulations pertaining to work practices, hauling, disposal and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state and local regulations. The contractor shall hold the owner harmless for failure to comply with any applicable work, hauling, disposal, safety, health, record keeping or other regulation on the part of himself, his employees, or his subcontractors.

E. Requirements which govern asbestos abatement work or hauling, and disposal of asbestos waste materials include but are not limited to the following:

1. U. S. Department of Labor, Occupational Safety and Health Administration (OSHA) including but not limited to:

    a. Title 20, Part 1910, Section 1001 and Part 1926, Section 58 of the Code of Federal Regulations.
    b. Respiratory Protection, Title 29, Part 1910, Section 134 of the Code of Federal Regulations.
    c. Construction Industry, Title 29, Part 1926, of the Code of Federal Regulations.
    d. Access to Employee Exposure and Medical Records, Title, 29, Part 1910, Section 2 of the Code of Federal Regulations.
    e. Hazard Communication, Title 29, Part 1910, Section 1200 of the Code of Federal Regulations.
    f. Specifications for Accident prevention Signs and Tags, Title 29, Part 1910, Section 145 of the Code of Federal Regulations.

2. U. S. Environmental Protection Agency (EPA) including but not limited to:

    a. National Emission Standards for Hazardous Air Pollutants (NESHAPS) Title 40, Part 61, Subpart M of the Code of Federal Regulations.
    b. Asbestos Hazard Emergency Response Act (AHERA), Public Law (99-519) applicable only on schools.
    c. Asbestos-Containing Materials in Schools: Title 40, Part 763 of the Code of Federal Regulations, applicable only on schools.

3. U. S. Department of Transportation (DOT)

    a. Title 49, Part 172, Section 101 of the Code of Federal Regulations.

4. State of Missouri

    a. H.B. 77, 85th General Assembly.
    b. Missouri Air Conservation Law, Chapter 643.
    c. Due to a recent court decision, the following Code of State Regulations do not apply to this specification:

1) 10 CSR 10-6.020, Definitions
2) 10 CSR 10-6.080, Emission Standards for Hazardous Air Pollutants.
3) 10 CSR 10-6.230, Administrative Penalties
4) 10 CSR 10-6.240, Asbestos Abatement Projects-Registration, Notification and Performance Requirements.
5) 10 CSR 10-6.250, Asbestos Abatement Projects - Certification, Accreditation, and Business Exemption Requirements.

END OF SECTION 02 82 00

SECTION 02 83 00 –PAINT REMOVAL, HANDLING AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. General: Various paint removal and/or paint preparations needed as part of renovation activities. All work shall be performed in accordance with the Environmental Protection Agency's Renovation, Repair and Painting (RRP) Program.

B. The Contractor shall supply all labor, materials, equipment, services, permits, notifications, insurance, and incidentals which are necessary or required to perform the work in accordance with applicable local, state, and federal regulations for the Scope of work detail herein.

C. All work must pass a final visual clearance performed by others.

D. Third party environmental oversight will be performed through an independent contract.

E. All work must be performed by a Contractor who has been trained in accordance with the EPAs RRP Program.

1.2 SUMMARY OF RENOVATION ACTIVITIES

A. The purpose of the specification is to notify the contractor of the presence of lead-based paint within the work area. Should renovation activities disturb lead-based paint, the work must be performed by a Contractor who has been trained in accordance with the EPAs RRP Program and shall implement dust control measures prior to beginning work. All waste generated from this project shall be properly characterized, containerized, transported, and disposed of in accordance with the applicable local, state, and federal regulations.

The Contractor is responsible for verifying all field conditions and quantities prior to submitting their bid.

1.3 TERMINOLOGY/DEFINITIONS/ABBREVIATIONS

A. Definitions:

1. Administrative Control: Written policies prepared before work begins which remove or prevent exposure to physical, biological, or chemical hazards.

2. Air Sampling Professional: An individual who by qualifications and experience is proficient in air monitoring and possesses a valid Missouri Certification and License.

3. Approved Waste Disposal Site: A solid waste disposal area that is authorized by the Department of Natural Resources to receive lead-based paint containing solid wastes.

4. Barrier: An envelope or containment that seals off the work area to inhibit the movement of particulate and dust particles.

5. Biological Monitoring: The analysis of a person's blood and/or urine, to determine the level of lead contamination in the body.

6. CFR: The Code of Federal Regulations, in the basic component of the Federal Register publication system. The CFR is a codification of the regulations of the various Federal Agencies.

7. Characteristics: The EPA has identified four characteristics of a hazardous waste: Ignitability; Corrosivity; Reactivity and Toxicity. Any solid waste that exhibits one or more of these characteristics is classified as a hazardous waste under RCRA.

8. Container: Any portable device, in which material is stored, transported, treated, disposed of, or otherwise handled.

9. Containment: A process for protecting both workers and the environment by controlling exposures to lead dust and debris created during renovation.

10. Contingency Plan: A document setting out an organized, planned, and coordinated course of action to be followed in case of a fire or explosion or a release of hazardous waste or hazardous waste constituents from the project site or a treatment, storage, or disposal facility that could threaten human health or the environment.

11. Contractor: Any business entity, public unit, or person, certified and licensed to conduct business in the State of Missouri and the employee have the EPA RRP training.

12. Discharge or Hazardous Waste Discharge: The accidental or intentional spilling, leaking, pumping, pouring, emitting, discharge emptying, or dumping of hazardous wastes onto any land or water or into the air.

13. Disposal Bag: A properly labeled 6 mil thick leak-tight plastic bag used for transporting waste from the work area to the disposal site.

14. Disposal Facility: A facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water, and at which the waste will remain after closure.

15. EPA Identification Number: The unique number assigned by EPA to each generator or transporter of hazardous waste, and each treatment, storage, or disposal facility.

16. Exposure Monitoring: The personal air monitoring of an employee's Breathing Zone to determine the amount of contaminant (e.g. lead) to which he/she is exposed.

17. Federal Register: A document published daily by the federal government that contains either proposed or final regulations.

18. Generator: Any person who first creates a hazardous waste, or any person who first makes the waste subject to the Subtitle C regulation (e.g., imports a hazardous waste, initiates a shipment of a hazardous waste from a TSD, or mixes hazardous wastes of different DOT shipping descriptions by placing them into a single container).

19. Hazardous Waste: As defined in RCRA the term "hazardous waste" means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

    a. Cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or

b. Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

As defined in the regulations a solid waste is hazardous if it meets one of four conditions:

1) Exhibits a characteristic of a hazardous waste (40 CFR Sections 261.20 through 262.24).

2) Has been listed as hazardous (40 CFR Section 261.31 through 261.33).

3) Is a mixture containing a listed hazardous waste and a non-hazardous solid waste (unless the mixture is specifically excluded or no longer exhibits any of the characteristics of hazardous waste).

4) Is not excluded from regulations as a hazardous waste.

20. Landfill: A disposal facility or part of a facility where hazardous waste is placed in or on land and which is not a land treatment facility, a surface impoundment, or an injection well.

21. Lead-Based Paint: Any surface coating (paint, varnish, shellac, etc.) that contains more than 600 parts per million (.06% by weight) as defined by the Consumer Products Safety Commission. Lead-based paint is 1 milligram of lead per square centimeter (1.0 mg/cm² as measured by XRF) or has a weight of 5,000 parts per million (.5% by weight) as defined by HUD.

22. Lead (inorganic), Pb: An element, which means that its atomic structure is permanently arranged and is not changed by chemical reactions. Lead can combine chemically with other atoms or molecules to make new compounds. Lead is considered a heavy metal: "heavy," because lead weighs much more than the same volume of water, and "metal," because when it is refined from raw ore into its pure form, lead can be hammered or drawn into shapes.

23. Listed: Hazardous wastes that have been placed on one of three lists developed by EPA: Non- specific source wastes; specific source wastes; commercial chemical products. These lists were developed by examining different types of waste and chemical products to see if they exhibit one of the four characteristics, meet the statutory definition of hazardous waste, are acutely toxic or acutely hazardous, or are otherwise toxic.

24. Manifest: The shipping document, EPA form 8700-22, used for identifying the quantity, composition, origin, routing, and destination of hazardous waste during its transportation from the point of generation to the point of treatment, storage, or disposal.

25. Owner: The State of Missouri.

26. Pattern: The process of identifying specific building components containing lead-based paint at a hazardous level within a project or group of buildings.

27. Permissible Exposure Limit or PEL: The highest average amount of lead that you are allowed to breathe over an 8 hour period. The OSHA PEL for General Construction is 50 ug/m3.

28. Personal Samples: (for sampling lead dust) - Air samples collected from within the Breathing Zone of a worker, but outside the respirator. The samples are collected with a personal sampling pump, pulling 1 to 4 liters/minute of air.

29. Project Manager: An employee of the Division of Facilities Management, Design and Construction, representing the Director during the length of the project.

30. RCRA: Resource Conservation and Recovery Act of 1976. An amendment to the Solid Waste Disposal Act of 1965. RCRA was amended in 1980 and most recently on November 8, 1984 by Hazardous and Solid Waste Amendments.

31. Regulation or Rule: All or part of any Federal statement of general or particular applicability and future effect designed to: (1) implement, interpret, or prescribe law or policy, or, (2) describe the Federal Department's organization or its procedures or practice requirements.

32. Representative Sample: A sample of a universe or whole (e.g., waste sample pile, lagoon, ground water, or waste stream) which can be expected to exhibit the average properties of the universe or whole.

33. Site: The land or water area where any facility is physically located or conducted, including adjacent land used in connection with the facility or activity.

34. Solid Waste: As defined in RCRA the term "solid waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under the Clean Water Act, or special nuclear or byproduct material as defined by the Atomic Energy Act of 1954.

35. Storage: The holding of hazardous waste for a temporary period, at the end of which time the hazardous waste is treated, disposed of, or stored elsewhere.

36. Substrate: A surface upon which a finish material (paint, etc.) has been or may be applied. Examples of substrates include wood, plaster, metal, and drywall.

37. Toxic Characteristic Leaching Procedure or TCLP: A test designed to identify wastes likely to leach hazardous concentrations of particular toxic constituents into the ground water as a result of improper management. This test provides the determination of whether a solid waste is classified as a hazardous substance.

38. Toxicity: A characteristic of hazardous waste as measured by the TCLP.

39. Transporter: Any person engaged in the off-site transportation of hazardous waste within the United States, by air, rail, highway, or water, if such transportation requires a manifest under 40 CFR Part 262.

40. Treatment: Any method, technique or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize it, or render it non-hazardous or less hazardous, or to

recover it, make it safer to transport, store or dispose of, or amenable for recovery, storage, or volume reduction.

41. TSD: A treatment, storage, or disposal hazardous waste facility.

42. Waste Disposal Site: A solid waste disposal area that is authorized by the Missouri Department of Natural Resources to receive lead containing solid waste.

43. Waste Shipment Record: The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of lead containing waste material.

B. Abbreviations:

ASTM: American Society for Testing and Materials.

DNR: Missouri Department of Natural Resources, 10 CSR 25 – Hazardous Waste Management. 260.350 – 260.575 – RSMo.

DHSS: Missouri Department of Health & Senior Services – Lead Poisoning Prevention.

DOT: U.S. Department of Transportation

EPA: U.S. Environmental Protection Agency

FMDC: Missouri Division of Facilities Management, Design & Construction

NIOSH: National Institute for Occupational Safety and Health

NVLAP: National Voluntary Laboratory Accreditation Program

OSHA: Occupational Safety and Health Administration, U.S. Department of Labor

RRP: Remove Replace Paint

1.4 SUMMARY OF REQUIREMENTS

A. All work performed on this project shall be done in the strictest accordance with applicable federal, state, and local regulations, standards and codes governing the renovation activities described in this scope of work. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.

B. The most recent edition of any relevant regulation, standard, document, or code shall be in effect. Where conflict among requirements or these specifications exists, the most stringent requirements shall be utilized.

C. Because ingestion or inhalation of lead containing dust is a serious health hazard, construction work involving lead-based paint is regulated by the Occupational Safety and Health Administration Regulations. Compliance with OSHA regulations in the completion of this project is the **sole** responsibility of the Contractor. OSHA regulations include, but are not limited to, conducting daily personnel air monitoring. However, the following requirements will apply regardless of the removal methods to be employed:

a. Regardless of the removal methods employed, the Contractor shall immediately stop work in the event of any of the following:

1) Visible Emissions.
2) Breathing Zone air samples exceed the PEL or Excursion Limit; furthermore, the Contractor shall implement corrective work practices, upon the approval of the owner, make re-notification to all regulatory agencies of the changes in work practices and material conditions, and comply with all referenced regulations in this document and the applicable sections of this specification as noted.

b. If any of the conditions in subparagraph "a" above are observed by the Construction Administrator, these parties have the right to issue a directive to stop work. The Contractor shall be obligated to implement corrective action. The Contractor shall not be entitled to additional compensation.

A. Lead-Based Paint: This scope of work includes the disturbance of paint which has been identified as being lead-based paint, and therefore all applicable federal, state, and local requirements, including notifications, should be followed. This renovation is being performed as an RRP project; therefore, notification to the Missouri Department of Health and Senior Services (DHSS) will not be required.

1. Make notifications in compliance with Section 2.1 of this specification.

2. Disposal of all paint shall be performed in compliance with the federal and state regulations as listed but not necessarily limited to those under section 2.11 of this specification. It is the Contractor's responsibility to perform all necessary testing if the waste will not be handled and disposed of a hazardous waste.

1.5 PROJECT COORDINATION

A. Contractor shall coordinate and schedule all phases of the work of the contract documents under his control with the Construction Administrator, Facility Representative, any subcontractors, materials suppliers, and other parties involved as necessary to ensure the smooth and orderly transition of separate phases, timely placement of items and materials, cooperation between parties, and proper execution of the work. **Contractor must give the Owner at least two business days' notice of start of work or change of work schedule. The Contractor will be required to reimburse the State of Missouri for hours worked and for their expenses if the Consultant mobilizes and work has been canceled, delayed, or postponed for that day.**

B. All coordination necessary with the facility will be made through the Facility Representative or their designated representative. The Construction Administrator and Facility Representative prior to the start of any work will approve scheduling and access to the work areas.

C. Normal working hours of the facility will be observed in performing the work unless the Facility Representative and Construction Administrator approve the modification as addressed prior to project beginning.

D. Contractor shall coordinate any news media inquiries or releases with the Facilities Management Design and Construction Division at (573) 751-3339.

E. The Contractor, project superintendent, subcontractors, and other appropriate parties shall attend meetings as scheduled and as otherwise necessary to accomplish the work in a timely and efficient manner. Meetings may include, but are not limited to, the following:

1. Pre-Construction Meeting: The Construction Administrator will schedule the pre-construction meeting after the Notice of Award has been issued. The Construction Administrator will determine the date, time, and exact place of this meeting and all necessary parties will be notified. During the meeting, discussions will be held in regard to construction procedures, scheduling requirements, general conditions, special conditions, channels of communication, responsible persons, requirements for submittals, documentation requirements, payment applications, and other pertinent information necessary for completing the work. Specific requirements of the facility in regard to security, safety, utilities, access to buildings, and related matters will also be discussed.

2. If, in the opinion of the Construction Administrator, additional meetings are required to maintain progress or scheduling requirements on the work, additional meetings will be scheduled.

F. All fees required for notification requirements, re-notifications, and/or inspections by the applicable local, state, or federal agencies shall be paid by the Contractor. This is a renovation project and therefore notification the Missouri DHSS is not required.

PART 2 - EXECUTION

2.1 NOTIFICATIONS

B. This project will be performed as an RRP interior renovation project; therefore, notification to the Missouri DHSS will not be required.

C. The Contractor is responsible for notifications, and associated fees to other local, state or federal agencies (i.e. construction permits, etc.)

2.2 SUBMITTALS

A. The following items are required to be submitted by the Contractor prior to the commencement of work and are subject to approval by the Owner's Representative. The Contractor shall send one copy of the submittals for approval and then send approved copies of the submittals to the distribution list as discussed at the Pre-Construction Conference.

1. Proof of EPA RRP training for the individuals that may disturb the painted surfaces

2. Provide a disposal plan to detail the types of disposal containers to be used, the methods of transportation to the disposal site, the waste hauler, and disposal site.

B. Prior to final acceptance of the project, the following items must be submitted to the Contractor Administrator:

1. Waste Disposal Receipts: The waste transporter's manifest and the landfill receipts on all lead containing waste removed from the project.

2. Close-out documentation required by the General Conditions, i.e., certified payrolls, Final Receipt of Payment and Release Form, Compliance with Prevailing Wage Affidavit and MBE/WBE reports.

C. Upon completion of the work and prior to final payment, the following information must be submitted to the Construction Administrator.

1. Waste disposal receipts and waste shipment records on all lead waste removed from the project. The Waste Shipment Record and Receipt form (or something similar) must be used for every load brought to the waste disposal site. The disposal and/or shipment record must include the following information:

a. Work site name and address
b. Project Number
c. Owner's name and telephone
d. Operator's (Contractor's) name, address, and telephone
e. Waste Disposal Site name, address, and telephone
f. Name and address of responsible agency
g. Type of materials and quantity in cubic yards or tons.
h. Name, address and phone number of transporter, and date of transport
i. Name, address and phone number of Waste Disposal Site representative and date material was received.

2. Any other specific requirements spelled out in the General Conditions.

2.3 DRAWINGS

A. For the purpose of this specification, drawings, when provided, are not intended to be used for anything other than a "reference" to the work area. Information is not specific to quantities or to the exact location of paint to be removed. The Contractor is required to field verify the conditions, locations, and quantities referenced.

2.4 LOCAL AREA PROTECTION/SITE SECURITY

A. The Contractor shall be responsible for all areas of the building used by him and/or subcontractors in the performance of the work. He shall exert full control over the actions of all employees and subcontractors with respect to the use and preservation of the existing building, except such controls as may be specifically reserved to the owner by these specifications.

B. The Contractor has the right to exclude from the work area all persons who have no purpose related to the work or its inspection, and shall require all persons in the work area to observe the same regulations as he requires his employees.

C. The Contractor shall have control of site security during renovation in order to protect his work and equipment. He will have the owner's assistance in notifying building occupants of impending activity and enforcement of restricted access by owner's employees.

D. The Contractor shall keep, as a minimum, two 10-pound type ABC fire extinguishers on site at all times. One extinguisher will be maintained outside the work area and one inside the work area. The Contractor's employees shall be trained in the use and operation of the extinguishers.

E. The Contractor shall use as small an area as necessary for storage of supplies and equipment and shall keep such in a neat and orderly fashion.

F. Access to emergency exits, stairways, emergency disconnects (i.e. fire suppressant, electrical, plumbing, etc.), and all other important building systems must remain unrestricted during the project. The Contractor must submit a written request to the Facility Representative if their work (i.e dust barriers, equipment, etc.). will limit access to the building or important building systems.

G. Contractor is prohibited from entering portions of the building not required for completion of their scope of work.

H. The Contractor must secure access into the work area to prevent public entrance. The Contractor should post warning tape and install warning signs at each door leading to the work area. All signage should be kept within the office suite.

J. The Contractor shall maintain the work area free from rubbish, debris, and dirt and keep a clean safe work area. The Contractor shall take measures to keep surfaces free from contamination or shall clean and lock down surfaces after work is done, protect with plastic sheeting and/or plywood during work, or remove from the work area. Trash must be removed daily and will not be allowed to accumulate.

K. Contractor is responsible for all damage to the structure other than that required to complete the scope of work outlined herein. At the conclusion of the project, the Contractor must repair such incidental damage including tape and glue residue, paint coatings and damage to surfaces, finishes and building components.

L. All signage, equipment and material shall be kept within the office suite.

2.5 WORKER PROTECTION/TRAINING

A. The Contractor shall be responsible for providing his employees with proper respiratory protection, respiratory training, a written respirator program, medical examinations, protective clothing and equipment and for maintaining medical records to comply with OSHA requirements.

B. The Contractor shall be responsible for all testing and costs incurred for complying with requirements OSHA regulations for personal monitoring, including but not limited to, all applicable air and blood sampling.

C. All workers are to be trained in the dangers inherent in handling lead containing materials, breathing lead dust, and in proper work procedures and personal and protective measures.

D. All work must be performed by individuals who have been trained in accordance with the EPAs RRP Program.

2.6 EMERGENCY PROTECTION PLAN

A. The Contractor shall be responsible for developing a written site-specific Emergency Protection Plan and shall maintain this plan on site. The plan shall include considerations for fire, explosion, toxic atmospheres, electrical hazards, slips, falls, and heat related injury. All employees shall be instructed and trained in the procedures. The plan shall also include contact information for local emergency personnel including

the police, fire, and medical services and the nearest hospital/emergency medical treatment facility.

2.7 PROJECT SUPERINTENDENT

A. The Contractor shall designate a project superintendent, who will serve as the Contractor's representative on the project and will ensure that all work is performed in compliance with all applicable regulations and following minimum requirements:

1. The Superintendent and crew must be trained in accordance with the Environmental Protection Agency's Renovation, Repair and Painting (RRP) Program and must have at least one-year full time experience in working with lead-based paint.

2. Shall be on site whenever work is going on.

3. Maintain a daily log documenting project events, visitations/inspections, problems, and accidents.

4. Implement first aid, safety training, respiratory protection, and ensure workers are trained in emergency procedures.

5. Conduct visual inspection of the work area prior to the final, third party, inspection. This inspection shall be documented.

6. Supervise activities of any subcontractors of the Contractor to ensure compliance with contract documents.

2.8 THIRD PARTY AIR MONITORING

A. The Contractor will contract with an independent party, acceptable to the Construction Administrator, to perform the following minimum duties:

1. Review Contractor's work plan and provide third party recommendations;

2. Collect air samples periodically during the RRP renovation project. Air samples shall be analyzed by NIOSH methods 7105, 7082, or 7300;

3. Provide Construction Administrator with periodic project reports describing amount and type of work done and other project concerns;

4. A visual inspection of the work area will be conducted prior to final RRP renovation clearance;

5. Review Contractor's disposal documentation;

6. Laboratories shall be accredited by ELLAP (AIHA – Environmental Lead Laboratory Accreditation Program) and NLLAP (EPA – National Lead Laboratory Accreditation Program); and

7. Neither the Contractor, nor any of its principals, officers, or directors may have any financial or business interests in any laboratory utilized on this contract.

2.9 FINAL CLEARANCE REQUIREMENTS

A. The work area, including all equipment, dust barriers must remain in place and operational until work area is cleared by the Owner or Owner's Designated Representative and the Construction Manager in accordance with this section.

B. Following the completion of the renovation work, the project superintendent shall notify the Construction Administrator. The superintendent shall then perform a visual inspection of the work area. If satisfactory, they shall contact the Contract Administrator to perform a visual inspection.

C. Renovation activities are not considered to be complete until the visual clearance is acceptable.

2.10 RE-ESTABLISHMENT OF THE WORK AREA AND SYSTEMS

A. Re-establishment of the work area shall only occur after the Contractor has complied with the clearance requirements of Section 2.9. Once the project's clearance criteria have been met, the Contractor may remove barriers, signs, trash, and equipment from the site.

B. The entire area shall be cleaned, using a HEPA vacuum and wet wiping, as a final step to the renovation process.

C. All damage to finishes, equipment, and/or the area affected by the renovation shall be repaired by the Contractor to equal or better condition as was prior to the work, at no cost to the owner.

2.11 WASTE DISPOSAL

A. The lead containing debris/paint should be treated as a hazardous waste unless the Contractor performs the appropriate and applicable TCLP analysis to suggest otherwise. Representative sampling should be performed in accordance with all applicable local, state, and federal regulations. If the Contractor chooses to collect a representative sample of all lead containing debris for a TCLP analysis, the sample locations should be clearly marked or otherwise identified for future review by the Owner or Owner's Representative. Note that if performed, the TCLP analysis should be performed not only for lead, but for all eight RCRA heavy metals. If the waste does not exceed the regulatory threshold for hazardous waste, the waste may be treated as special waste and disposed in a sanitary landfill, following the applicable local, state of federal regulations.

2.12 CODES AND REGULATIONS

A. This section sets forth governmental regulations and industry standards, which are included and incorporated herein by reference and made a part of this specification.

B. Requirements include adherence to work practices and procedures set forth in applicable codes, regulations, and standards.

C. General Applicability of Codes, Regulations and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations standards, statutes, laws and rules have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies

are bound herewith. In the event of conflicting applicable codes, regulations, standards, statutes, laws, or rules, the more stringent shall apply to these specifications.

D. Contractor Responsibility: The Contractor shall assume full responsibility and liability for compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the owner harmless for failure to comply with any applicable work, hauling, disposal, safety, health, record keeping or other regulation on the part of himself, his employees, or his subcontractors.

END OF SECTION 02 83 00

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

A. Material certificates.

B. Material test reports.

1.4 QUALITY ASSURANCE

A. 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."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Concrete Testing Service: Contractor engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Moisture Vapor Reduction Admixture Warranty

1. Manufacturer’s Warranty: Submit, for the owner’s acceptance, the manufacturer’s standard warranty document executed by an authorized company official. The manufacturer’s warranty is in addition to, and not a limitation of, other rights the Owner may have under provisions of the contract documents.
2. Warranty Period: Ten years commencing on the date of acceptance of the project by the Owner or Notice of Completion whichever is earliest.

a. Warranty Terms: Terms to include moisture related failures, including all finish floor materials and labor. Admixture warranty issued on completion of ASTM-D-5084 or ASTM-D-4263 test and results submitted to a Systems Representative.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

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.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. 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.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150 Type I/II, gray. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F or C.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, graded.

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.

C. Water: ASTM C 94/C 94M and potable.

2.4 ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will 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.

7. Moisture Vapor Reduction Admixture:

   a. Acceptable Products:
      1) Concure Systems
      2) Barrier One
      3) Vapor Lock 20/20

2.5 WATERSTOPS

A. 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).

B. 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).

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

2.9 CONCRETE MIXTURES

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.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 20 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.

D. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As required by prints at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50 – footings; 0.45 – all other mixes

3. Slump Limit: 4 inches (125 mm) or 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: Do not allow air content of trowel-finished floors to exceed 3 percent.

5. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

a. Add water vapor reducing admixture per manufacturers specified dosage rate to ready mix truck at the batch plant, or jobsite before discharge, mix rapidly for 7 minutes. (Follow Manufacturer’s Instructions).

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, 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.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

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.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 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.

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. 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 will 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.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be 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. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.7 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.

C. 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.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. 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 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 and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm) at the gymnasium floor and 1/4" (6.4mm) at all other locations.

3.9 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 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. 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.

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.

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 unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

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.

3.10 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.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 03 3000

SECTION 03 5413 - GYPSUM CEMENT UNDERLAYMENT

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 gypsum-cement-based, self-leveling underlayment for application below interior floor coverings.

B. Provide self-leveling underlayment at areas indicated on Drawings, Refer to the Room Finish Schedule for locations.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: Signed by manufacturers of underlayment and floor-covering systems certifying that products are compatible.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.

1. Place gypsum-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

1.8 COORDINATION

A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.1 GYPSUM-CEMENT-BASED UNDERLAYMENTS

A. Underlayment: Gypsum-cement-based, self-leveling product that can be applied in minimum uniform thickness of 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

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. ARDEX Americas.
b. Maxxon Corporation; Dura-Cap.
c. USG Corporation; Levelrock 4500.

2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C 219.
3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.

1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb. of water/1000 sq. ft. in 24 hours.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 5413

SECTION 04 4200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Embedded flashing.

B. Related Requirements:

1. Section 07 6200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 INFORMATIONAL SUBMITTALS

A. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

B. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi .
2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, 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 is not more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

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

a. Cemex S.A.B. de C.V.

b. Holcim (US) Inc.
c. Lafarge North America Inc.
d. Lehigh Hanson; HeidelbergCement Group.

E. Mortar Cement: ASTM C1329/C1329M.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Cemex S.A.B. de C.V.
b. Holcim (US) Inc.
c. Lafarge North America Inc.

F. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

G. Aggregate for Grout: ASTM C404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

I. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet.

2.6 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.

2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Tie Section: Triangular-shaped wire tie made from diameter, hot-dip galvanized steel wire.
2. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.060-inch-thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.

    a. 0.064-inch- thick, galvanized sheet may be used at interior walls unless otherwise indicated.

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 A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel , with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
5. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
6. Solder metal items at corners.

B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 0.040 inch thick.

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

        1) Carlisle Coatings & Waterproofing Inc.
        2) Elevate; Holcim Building Envelope.
        3) Heckmann Building Products, Inc.
        4) Hohmann & Barnard, Inc.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge .
4. Where flashing is fully concealed, use or flexible flashing.

D. 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 D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.9 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 masonry cement or mortar cement mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime masonry cement or mortar cement mortar.
4. For reinforced masonry, use portland cement-lime masonry cement or mortar cement mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Property 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 reinforced masonry, use Type N.
2. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
3. For interior nonload-bearing partitions, Type O may be used instead of Type N.

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 TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.

5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

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 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. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints to match existing or slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 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 CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. 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.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.8 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 9200 "Joint Sealants" for application indicated.
3. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 9200 "Joint Sealants" for application indicated.
4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
6. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.9 FIELD QUALITY CONTROL

3.10 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. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. 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. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.11 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. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2200

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes structural steel and grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer, fabricator, and testing agency.

B. Welding certificates.

C. Mill test reports for structural steel, including chemical and physical properties.

D. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.

2. AISC 360.

3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 572/A 572M, Grade 50 (345).

B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.2 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. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight.

2. Finish: Plain.

E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Finish: Plain.

F. Threaded Rods: ASTM A 36/A 36M.

1. Finish: Plain.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

B. 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.

2.6 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.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 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 to be high-strength bolted with slip-critical connections.

4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

5. Galvanized surfaces.

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."

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.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Contractor will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected 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 will not be accepted.

3. Ultrasonic Inspection: ASTM E 164.

4. Radiographic Inspection: ASTM E 94.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing 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 Pretension 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's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 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.

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.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 051200

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing wall framing.

2. Interior load-bearing wall framing.

3. Exterior non-load-bearing wall framing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification data.

B. Welding certificates.

C. Product test reports.

D. Research/evaluation reports.

1.4 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code--Sheet Steel."

C. 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.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."

2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

E. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.2 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 indicated on drawings.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and same minimum base-metal thickness as steel studs.

C. 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: 0.0428 inch (1.09 mm).

2. Flange Width: 1-5/8 inches (41 mm.

2.3 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: 0.0428 inch (1.09 mm).

2. Flange Width: 1-5/8 inches (41 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and same minimum base-metal thickness as steel studs.

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.

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.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

2.4 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, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

C. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

D. 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.

E. 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 independent testing agency.

F. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 PREPARATION

A. 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.

B. 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.

3.2 INSTALLATION, GENERAL

A. 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.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

C. Install framing members in one-piece lengths.

D. 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.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. 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.

G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. 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 (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As shown on Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.

2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced as indicated. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.

2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

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 top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated].

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 deflection tracks and anchor to building structure.

2. Install double deflection tracks and anchor outer track to building structure.

3. Connect vertical deflection clips to bypassing studs and anchor to primary building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Drawings. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches (305 mm) 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.

a. Install solid blocking at centers indicated.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

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 curtain-wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: 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.

3.6 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

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Miscellaneous steel trim.
5. Window sill flashing
6. Window security bars and frames.
7. Metal bollards.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.2 COORDINATION

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 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:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.
5. Manufactured metal ladders.
6. Metal angle corner guards.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Window security bars and frames.
3. Metal ladders.
4. Miscellaneous steel trim including steel angle corner guards .

5. Loose steel lintels.

C. Delegated Design Submittals: For ladders , 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 in accordance with the following welding codes:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance of Aluminum Ladders: Ladders are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

B. Structural Performance of Alternating Tread Devices: Alternating tread devices are to 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. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .

2.2 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. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304 .

D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

F. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

G. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

H. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

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 B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening stainless steel .

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Anchors, General: 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 in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 9113 "Exterior Painting."

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

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 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 or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are 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.

J. 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.

1. Fabricate units from slotted channel framing where indicated.

2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 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 and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Aluminum Ladders:

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

   a. Fixfast USA.
   b. Halliday Products.
   c. O'Keeffe's Inc.
   d. Precision Ladders, LLC.
   e. Royalite Manufacturing, Inc.
   f. Thompson Fabricating, LLC.
   g. UPNOVR, Inc.

2. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
3. Space siderails 16 inches apart unless otherwise indicated.
4. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
5. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces. Space rungs at 12” O.C.
6. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets. Provide 7” clearance between rung and wall surface.

7. Provide platforms as indicated fabricated from pressure-locked aluminum bar grating or extruded-aluminum plank grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 1/2 inch in least dimension.
8. Support each ladder at top and bottom and not more than 60 inches>o.c. with welded or bolted aluminum brackets.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

2.10 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.

B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.11 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 no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. 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 indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

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 Steel Items: SSPC-SP 3, "Power Tool Cleaning."
4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. 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.

2.14 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

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 screws, 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 INSTALLATION OF 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 ceiling-hung toilet partitions operable partitions overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction with expansion anchors .

3.3 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF MISCELLANEOUS STEEL TRIM

A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.5 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

    a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9113 "Exterior Painting." Section 09 9123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 5000

SECTION 06 4116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.

B. Product Data Submittals: For each product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings:

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 items installed in plastic-laminate architectural cabinets.

D. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.

    a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches, for each color, pattern, and surface finish.

    a. Provide edge banding on one edge.

3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature about 75 deg F and relative humidity between 45 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.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS: (PL-1)

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Premium.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following as Listed in “Interior Finish Key” in Drawings:

a. Wilsonart
b. Formica
c. Nevamar

F. Exposed Surfaces:

1. Plastic-Laminate Grade: HGS for horizontal surfaces and VGS for vertical surfaces.
2. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative material (melamine).

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
b. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding.
c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of Thermoset decorative material (melamine) to match exposed surface.

2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermally fused laminate panels.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.

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.

J. 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 listed in the “Interior Finish Key” in Drawings.
2. As selected by Architect from laminate manufacturer's full range in the following categories:

a. Wood grains, Finish as listed in the “Interior Finish Key” in Drawings.
b. Patterns, Finish as listed in the “Interior Finish Key” in Drawings.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Particleboard (Medium Density): ANSI A208.1, Grade M-2 or Better.
2. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of ISO 4586.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 7100 "Door Hardware".

B. False Front Connectors: Hafele Keku Push-In Fittings # 262.50.313.

1. For removal of aprons at sink and lavatories.

C. Metal Support Brackets:

1. Manufacturers: Subject to compliance with requirements, provide by:

a. Basis of Design: Rakks

1) Vanity Support Bracket – ADA Compliant (18”x21-1/2”) supports countertops up to 24” deep.

a) Finish: Mill (Unfinished)
b) Spacing: maximum 32” center to center.

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1) Rakks ADA Vanity Bracket
2) Counter Balance ADA Vanity Bracket
3) Hafele ADA Vanity Bracket

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood 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. Adhesive for Bonding Plastic Laminate: Type I, waterproof type or Type II water-resistant type as selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings 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.
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.

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 architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 4116

SECTION 07 2413 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Polymer-based exterior insulation and finish system (EIFS).

1. EIFS-clad barrier-wall assemblies that are field applied over substrate.

2. Patches and repairs to existing EIFS.

B. Related Requirements:

1. Section 07 2723 "Board Product Air Barriers" for insulation-board AWB systems behind mechanically fastened EIFS.

1.2 DEFINITIONS

A. Definitions in ASTM E2110 apply to Work of this Section.

B. EIFS: Exterior insulation and finish system(s).

C. IBC: International Building Code.

D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E2568.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each EIFS component, trim, and accessory.

B. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of exposed accessories involving color selection.

C. Samples for Verification: 24-inch- square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work, including an aesthetic reveal.

1. Include a typical control joint filled with sealant of color selected, as specified in Section 07 9200 "Joint Sealants."

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer fabricator/erector.

B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:

1. EIFS substrate is acceptable to EIFS manufacturer.
2. Accessory products installed with EIFS, including joint sealants, flashing, water-resistant barriers, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.

C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For EIFS to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers .

B. Fabricator/Erector Qualifications: Certified in writing by EIFS manufacturer as qualified to fabricate and erect manufacturer's prefabricated panel system using skilled and trained workers.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. 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 materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Bond integrity and weathertightness.
b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.

2. Warranty coverage includes the following EIFS components:

a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
b. Insulation installed as part of EIFS , including buildouts.
c. Insulation adhesive and mechanical fasteners.
d. EIFS accessories, including trim components and flashing.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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

1. Dryvit, part of Tremco CPG.
2. Master Wall Inc.
3. Senergy; Master Builders Solutions.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with ASTM E2568 and with the following:

1. Weathertightness: Resistant to water penetration from exterior.
2. Impact Performance: ASTM E2568, Medium impact resistance unless otherwise indicated.
3. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested in accordance with ASTM D968, Method A.
4. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate; cured for 28 days and shows no growth when tested in accordance with ASTM D3273 and evaluated in accordance with ASTM D3274.

2.3 EIFS MATERIALS FOR NEW INSTALLATION & REPAIRS

A. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

B. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with one of the following:

1. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
2. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.

C. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:

1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, in accordance with ASTM E84.
2. Dimensions: Provide insulation boards of not more than 24 by 48 inches, with thickness indicated on Drawings.
3. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.

D. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. in accordance with ASTM E2098/E2098M and the following:

1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
2. Strip-Reinforcing Mesh: Not less than 4.0 oz./sq. yd. As recommended by EIFS manufacturer .
3. Detail-Reinforcing Mesh: Not less than 6.0 oz./sq. yd. As recommended by EIFS manufacturer .
4. Corner-Reinforcing Mesh: Not less than 7.2 oz./sq. yd. As recommended by EIFS manufacturer .

E. Base Coat: EIFS manufacturer's standard mixture complying with one of the following:

1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
2. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

F. Water-Resistant Base Coat: EIFS manufacturer's standard waterproof formulation complying with one of the following:

1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.

G. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners, consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:

1. For attachment to light-gage steel framing members not less than 0.0179 inch in thickness, provide steel drill screws complying with ASTM C1002.
2. For attachment to insulation-backed sheathing, provide manufacturer's standard fasteners suitable for substrate.
3. For attachment to masonry, provide manufacturer's standard fasteners suitable for substrate.

H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

I. Finish Coat: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
2. Colors: As selected by Architect from manufacturer's full range.
3. Textures: As selected by Architect from manufacturer's full range.

J. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.

K. Water: Potable.

L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784 and ASTM C1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation, with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant, 3/4-inch minimum.
4. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.

2.4 MIXING

A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

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 roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION FOR EIFS REPAIRS

A. Identify damaged areas and determine area of removal and replacement is large enough to work within even if the damaged area is small. Cut around damaged areas cutting through all layers to the substrate. Carefully remove EIFS lamina.

B. Use a hand-held grinder or similar device to remove the finish surrounding the removed section of EIFS. Do not grind into reinforcing mesh; remove finish in a uniform area, at least 3-inches in all directions surrounding the removed portions of EIFS.

C. Remove dust, EPS beads and other debris from cutting and grinding. Clean area in preparation for EIFS patch installation.

D. Cut new EPS to the shape of the EPS void, creating a tightly fitting repair. Apply base coat to new EOS and press into place. Allow the adhesive to dry. Insert EPS slivers into any gap greater than 1/16-inch wide. Do not fill gaps between insulation board with base coat. Sand or rasp the surface flush with adjacent EPS.

E. Mask the existing finish around the repair area.

F. Cut reinforcing mesh so it overlaps at least one inch onto existing base coat and mesh. Embed reinforcing mesh into base coat, ensuring that the fresh base coat and mesh is level with existing lamina. Use a double layer of reinforcing mesh when repairing damaged corners. Allow to dry and scrape any trowel marks prior to finish application.

G. Apply color and texture finish. Float the finish to match existing finish. Remove the masking tape before the finish dries and use a brush to blend the wet edge of the finish into existing finish and allow to dry.

3.3 PREPARATION FOR EIFS INSTALLATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.

1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.4 INSTALLATION OF EIFS, GENERAL

A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

3.5 APPLICATION OF SUBSTRATE PROTECTION

A. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.6 INSTALLATION OF TRIM

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at windowsills, and elsewhere as indicated. Coordinate with installation of insulation.

1. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
2. Windowsill Flashing: Use at windows unless otherwise indicated.
3. Expansion Joint: Use where indicated on Drawings.
4. Casing Bead: Use at other locations.

3.7 INSTALLATION OF INSULATION

A. Board Insulation: Adhesively and mechanically attach insulation to substrate in compliance with ASTM C1397 and the following:

1. Concrete or Masonry: Apply adhesive by ribbon-and-dab method.
2. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.
4. Mechanically attach insulation to sheathing substrate. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:

    a. Steel Framing: 5/16 inch.

    b. Masonry: 5/8 inch.

5. Apply insulation over dry substrates in courses, with long edges of boards oriented horizontally.
6. Begin first course of insulation from a level base line and work upward.
7. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
8. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.

    a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
    b. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.

9. Interlock ends at internal and external corners.
10. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
11. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
12. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/16 inch from surface of insulation and to remove yellowed areas due to sun exposure;

do not create depressions deeper than 1/16 inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.

13. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
14. Install foam buildouts and attach to structural substrate by adhesive .
15. Interrupt insulation for expansion joints where indicated.
16. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
17. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
18. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
19. Treat exposed edges of insulation as follows:

    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
    b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
    c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.

20. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where wall height or building shape changes.
4. Where EIFS manufacturer requires joints in long continuous elevations.
5. Where panels abut one another.

3.8 APPLICATION OF BASE COAT

A. Base Coat: Apply full coverage to exposed insulation and foam buildouts with not less than 1/16-inch dry-coat thickness.

B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

C. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.

D. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip-reinforcing mesh diagonally at corners of

openings (re-entrant corners). Apply 8-inch- wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

1. At aesthetic reveals, apply strip-reinforcing mesh not less than 8 inches wide.
2. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.

E. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.9 APPLICATION OF FINISH COAT

A. Primer: Apply over dry base coat.

B. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample. Texture to match existing finish.

C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.10 FIELD QUALITY CONTROL, INSPECTION AND TESTING

A. Inspection by the Architect or others does not absolve the applicator from his responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

B. Material Sampling: Owner may at any time and any number of times during the EIFS application require material samples for testing for compliance with requirements.

1. Contractor will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in the presence of Contractor, Architect and Construction Representative.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.11 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 2413

SECTION 07 2723 - BOARD PRODUCT AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation-board AWB systems.

1.2 DEFINITIONS

A. AWB: Air- and water-resistive barrier system.

B. AWB Assembly: The collection of AWB materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall and shed water to the exterior of the wall assembly.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review insulation-board AWB system requirements and installation, special details, mockups, air-leakage and bond testing, AWB system protection, and work scheduling that covers AWB systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For insulation-board AWB assemblies.

1. Show locations and extent of AWB system 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 AWB 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.

B. Product Certificates: From insulation-board AWB system manufacturer, certifying compatibility of insulation-board AWB system and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each insulation-board AWB assembly, for tests performed by a qualified testing agency.

D. Research Reports: For insulation-board AWB system, from ICC-ES showing compliance with ABAA.

E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For insulation-board AWB system.

B. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.7 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 in accordance with ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly , 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 insulation-board AWB system assembly.

    a. Include junction with roofing membrane , building corner condition, and foundation wall intersection.
    b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation-board AWB system 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 insulation-board AWB system as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply insulation-board AWB system within the range of ambient and substrate temperatures recommended in writing by insulation-board AWB system manufacturer.

1. Protect substrates from environmental conditions that affect AWB performance.
2. Do not apply insulation-board AWB system to a damp or wet substrate or during snow, rain, fog, or mist.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace insulation-board AWB system components that fail in materials within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Loss of thermal R-value beyond 10 percent over three years.

2. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain insulation-board AWB system components from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Insulation-Board AWB System Performance: Insulation-board AWB system 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. Insulation-board AWB system assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations , tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. pressure difference when tested in accordance with ASTM E2178.

C. Vapor Permeance: Minimum 12-16 perms when tested in accordance with ASTM E96/E96M, Desiccant Method, Procedure A.

D. Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. , when tested in accordance with ASTM E2357.

2.3 COMPOSITE INSULATING WALL SHEATHING SYSTEMS

A. Polyisocyanurate Board, 10 mil Thick Interior and 12 mil Thick Exterior Glass-Fiber-Reinforced Faced, AWB System : ASTM C1289, Type II, Class 1 or 2.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Zip System R Sheathing, a Huber Engineered Woods LLC company; or comparable product by one of the following:

    a. Johns Manville.
    b. IKO Commercial.
    c. Sika Company .

2. Thickness: 2.00 inches thick.
3. Size: 48 by 96 inches for vertical installation.
4. Edges: Square.
5. Flashing and Transitions Strips: As acceptable to insulation-board AWB system manufacturer.

    a. Provide primers, transition strips, termination 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 insulation-board AWB system manufacturer to produce a complete AWB assembly and that are compatible with primary AWB material and adjacent construction to which they may seal.

6. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.4 INSULATION FASTENERS

A. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction

1. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A 153M.
2. Power-Driven Fasteners: ICC-ES-1539 or NER-272.
3. Wood Screws: ASME B18.6.1.

2.5 ACCESSORIES

A. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148.

1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Tape
2. Thickness: 0.012 inch

B. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Reject insulation-board AWB system components that are wet, moisture damaged, or mold damaged.

B. Examine walls for suitable conditions where insulation-board AWB system will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances that are harmful to insulation-board AWB system, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Apply insulation-board AWB system components to form a seal with tape and to achieve a continuous air barrier in accordance with AWB system manufacturer's written instructions and details. Apply AWB system within manufacturer's recommended application temperature ranges.

C. Install insulation-board AWB system components that are undamaged, dry, and unsoiled and that have not been left exposed to ice, rain, or snow at any time.

D. Extend insulation-board AWB system to envelop entire area to be covered. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

1. Connect and seal exterior wall insulation-board AWB system materials 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.

E. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

F. Apply joint tapes and sealants forming part of insulation-board AWB system assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when tapes or sealant cannot be applied within these temperature ranges.

G. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation-board AWB system units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

H. Repair punctures, voids, and deficient seams. Patch with tape and, when needed, insulation board.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Insulation-Board AWB System: Attach sheathing panels securely to substratewith manufacturer-approved fasteners in compliance with the following: o.c. both ways on inside face and as recommended by manufacturer.

1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
2. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.

3. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.
4. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports
5. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs.
6. Apply seam tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

C. Inspections: Insulation-board AWB system materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of insulation-board AWB system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of insulation-board AWB system has been provided.
3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Compatible materials have been used.
7. Transitions at changes in direction and structural support at gaps have been provided.
8. Connections between assemblies (AWB system and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
9. All penetrations have been sealed.

D. Tests: As determined by testing agency from among the following tests:

1. Adhesion Testing: Insulation-board AWB system assemblies will be tested for required adhesion to substrate in accordance with ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

E. Insulation-board AWB system will be considered defective if it does not pass tests and inspections.

1. Repair insulation-board AWB system materials, according to manufacturer's written instructions, where inspection results indicate points of failure.
2. Remove and replace deficient insulation-board AWB system components for retesting as specified above.

F. Repair damage to AWB system caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed insulation-board AWB system 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.

B. Remove and replace insulation-board AWB system materials that are wet, moisture damaged, or mold damaged.

END OF SECTION 07 2723

SECTION 07 5323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ethylene-propylene-diene-terpolymer (EPDM) roofing.
2. Accessory roofing materials.
3. Substrate board.
4. Roof insulation.
5. Insulation accessories and cover board.
6. Secondary roof protection sheet.
7. Walkways.
8. Grease containment system.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry for wood nailers, curbs, and blocking.
2. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 7100 "Roof Specialties" for roof edge flashings.
4. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Ethylene-propylene-diene-terpolymer (EPDM) roofing.
2. Accessory roofing materials.
3. Substrate board.
4. Roof insulation.
5. Insulation accessories and cover board.
6. Walkways.

B. Product Data Submittals:

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.

4. Tapered insulation, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with air barrier.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

a. Submit evidence of complying with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.7 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.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, and other components of roofing system.
2. Warranty Period: 20 years from Date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, and walkway products, for the following warranty period:

1. Warranty Period: Two years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings to remain watertight.

1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane to resist impact damage when tested in accordance with ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing

system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification: Class 1A-105 .
2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH .

D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.

1. Wind Uplift Load Capacity: 90 psf .

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

A. EPDM Sheet: ASTM D4637/D4637M, Type I, nonreinforced, EPDM sheet with factory-applied seam tape.

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

   a. Carlisle Syntec Systems.
   b. Elevate; Holcim Building Envelope.
   c. Versico Roofing Systems; Carlisle Construction Materials.

2. Thickness: 60 mils , nominal.
3. Exposed Face Color: Black .
4. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.3 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, 55 to 60 mils thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

E. Roof Vents: As recommended by roof membrane manufacturer.

1. Size: Not less than 4-inch diameter.

F. Bonding Adhesive: Manufacturer's standard.

G. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- wide minimum, butyl splice tape with release film .

H. Lap Sealant: Manufacturer's standard, single-component sealant , colored to match membrane roofing.

I. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

J. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

K. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

L. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.

M. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

1. Provide white flashing accessories for white EPDM membrane roofing.

2.4 SUBSTRATE BOARD

A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Thickness: 1/2 inch .
2. Surface Finish: Factory primed .

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer**,** approved for use in FM Approvals' RoofNav-listed roof assemblies.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1 felt facer on both major surfaces.

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

a. Atlas Polyiso Roof and Wall Insulation.
b. Carlisle Syntec Systems.
c. CertainTeed; SAINT-GOBAIN.
d. Elevate; Holcim Building Envelope.

2. Compressive Strength: 25 psi.
3. Size: 48 by 48 inches .
4. Thickness:

a. Base Layer: 2 inches .
b. Upper Layer: 3 inches. .

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation .
2. Minimum Thickness: 1/4 inch.
3. Slope:

a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.6 INSULATION ACCESSORIES AND COVER BOARD

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation 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.

D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum substrate.

1. Thickness: 1/4 inch .
2. Surface Finish: Fiberglass facer .

E. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.

2.7 WALKWAY PADS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

1. Size: 30 inch width minimum and no greater than 60 inch length with minimum of 6 inches between each pad for positive drainage

2. Attachment: factory applied tape

2.8 GREASE CONTAINMENT SYSTEM

A. Grease containment system: bracketed, multi-layer filter system of hydrophobic material designed to resistant roof damage caused by cooking vent exhaust while allowing rainwater to pass through filtration system.

1. Frame: aluminum or galvanized steel bracket.
2. System Size: 60 inches square

3. System assembly: four-layer system with ¼” hold down rods

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 3100 "Steel Decking."
4. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.

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 system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system in accordance with roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

3.4 INSTALLATION OF SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

    a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck in accordance with recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
5. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Existing Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows and with long joints continuous at right angle to flutes of decking.

    a. Locate end joints over crests of decking.
    b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

        1) Trim insulation so that water flow is unrestricted.

    f. Fill gaps exceeding 1/4 inch with insulation.
    g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    h. Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

        1) Fasten insulation in accordance with requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification .
        2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

    a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
    b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
    f. Trim insulation so that water flow is unrestricted.
    g. Fill gaps exceeding 1/4 inch with insulation.
    h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    i. Adhere each layer of insulation to substrate using adhesive in accordance with FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

        1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.

2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

A. Install 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.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

    a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.

3.7 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.

B. Unroll membrane roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's Construction Representative.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.
3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

I. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

J. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

K. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

L. Adhere protection sheet over roof membrane at locations indicated.

3.8 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates in accordance with 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.

3.9 INSTALLATION OF WALKWAY PADS

A. Flexible Walkways: Install walkway products in accordance with manufacturer's written instructions.

1. Install flexible walkways at the following locations:

    a. Perimeter of each rooftop unit.
    b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
    c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
    d. Top and bottom of each roof access ladder.
    e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
    f. Locations indicated on Drawings.
    g. As required by roof membrane manufacturer's warranty requirements.
    h. Continuous under grease containment system

2. Provide 6-inch clearance between adjoining pads.
3. Adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

3.10 INSTALLATION OF GREASE CONTAINMENT SYSTEM

A. Containment system: Install products in accordance with manufacturer's written instructions.

1. Install system at the following locations:

a. At kitchen hood exhaust as indicated on the Drawings.

b. Install each layer per manufacturer's written requirements for proper function.

Install hold-down rods or clips to prevent uplift of filters.

2. Protect roofing substrate with continuous walk pad under grease containment system frame attachment points.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.12 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system 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 roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.13 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <**Insert name of Owner>**.
2. Owner Address: <**Insert address>**.
3. Building Name/Type: <**Insert information>**.
4. Building Address: <**Insert address>**.
5. Area of Work: <**Insert information>**.
6. Acceptance Date: _____.
7. Warranty Period: <**Insert time>**.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding <**Insert mph>**;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 5323

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Low-slope roof sheet metal fabrications.
2. Formed Sill Flashing sheet metal fabrications.
3. Formed Window Sill Pan sheet metal fabrications.
4. Wall sheet metal fabrications.

B. Related Requirements:

1. Formed Window Sill Pan sheet metal fabrications.
2. Section 07 7100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashings.
3. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

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 ACTION SUBMITTALS

A. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches .

B. Samples for Verification: For each type of exposed finish.

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.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

1.6 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.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
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. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to 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 are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and

SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, 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: 120 deg F , ambient; 180 deg F , material surfaces .

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
2. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range .
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304 , dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled) .

a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1) Run grain of directional finishes with long dimension of each piece.
2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

D. Metallic-Coated Steel Sheet: Provide aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A755/A755M.

1. Surface: Smooth, flat .
2. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare,

pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Color: As selected by Architect from manufacturer's full range .
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.

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

    a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
    b. Henry Company; a Carlisle company.
    c. Protecto Wrap Company.
    d. SDP Advanced Polymer Products Inc.

2. Source Limitations: Obtain underlayment from single source from single manufacturer.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners , solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

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. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

G. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. 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.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. 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 indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- long sections.
3. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness .
4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
5. Gutter Profile: Style B. Adapt profile to match existing. in accordance with cited sheet metal standard.
6. Expansion Joints: Lap type .
7. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:

    a. Aluminum: 0.040 inch thick.
    b. Galvanized Steel: 0.028 inch thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors . Shop fabricate elbows.

1. Provide mitered elbow and downspout extensions at lower roof.

    a. Downspout extension to be 4'-0" in length.
    b. Center end of extension on flexible walkway pad.

2. Hanger Style: Folded bar. .
3. Fabricate from the following materials:

    a. Aluminum: 0.080 inch thick.
    b. Galvanized Steel: 0.060 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Drip Edge) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6-inch- wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate .
2. Fabricate from the following materials:

a. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

D. Flashing Receivers: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

E. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

B. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder welds sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws .

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

    a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    b. Form joints to completely conceal sealant.
    c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
    d. Adjust setting proportionately for installation at higher ambient temperatures.

        1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder metallic-coated steel sheet.
3. Do not use torches for soldering.
4. Heat surfaces to receive solder, and flow solder into joint.

    a. Fill joint completely.
    b. Completely remove flux and spatter from exposed surfaces.

5. Stainless Steel Soldering:

    a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
    b. Promptly remove acid-flux residue from metal after tinning and soldering.
    c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

6. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.

3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Fasten gutter spacers to front and back of gutter.
7. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
8. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
9. Anchor gutter with gutter brackets spaced not more than apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
10. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Connect downspouts to underground drainage system.

D. Downspout Extensions:

1. Install where downspouts discharge on low-slope roofs .
2. Set on flexible walkway pad in elastomeric sealant compatible with the substrate.

3.4 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements , sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.
4. Secure in waterproof manner by means of anchor and washer spaced at 12 inches o.c. along perimeter and 6 inches o.c. at corners areas unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 INSTALLATION OF MISCELLANEOUS FLASHING

3.7 INSTALLATION 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 indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.9 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in 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, as determined by Architect.

END OF SECTION 07 6200

SECTION 07 7100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof-edge specialties.
2. Roof-edge drainage systems.
3. Reglets and counterflashings.

B. Related Requirements:

1. Section 07 6200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
2. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Section 07 9200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.2 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
2. Include roof-edge specialties roof-edge drainage systems reglets and counterflashings made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are SPRI ES-1 tested to specified design pressure.

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 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. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 07 5323 " Ethylene-Propylene-Diene-Monomer (EPDM) Roofing”

B. 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 Delta E units when tested in accordance with ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties to 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 in accordance with SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings .

2.2 ROOF-EDGE SPECIALTIES

A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.

1. Manufacturers: Subject to compliance with requirements, undefined:

   a. Drexel Metals Corp.
   b. Englert, Inc.
   c. Fabral; a brand of Flack Global Metals.
   d. Metal-Era, Inc.

2. Metallic-Coated Steel Sheet Fascia Covers: Zinc-coated (galvanized) steel, nominal 0.034-inch thickness .

   a. Surface: Smooth, flat finish.
   b. Finish: Two-coat fluoropolymer .
   c. Color: As selected by Architect from manufacturer's full range .

3. Corners: Factory mitered and soldered .
4. Splice Plates: Concealed , of same material, finish, and shape as fascia cover.
5. Receiver: Manufacturer's standard material and thickness.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

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

1. Architectural Products Company.
2. Drexel Metals Corp.
3. Metal-Era, Inc.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet , with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Zinc-Coated Steel: Nominal 0.034-inch thickness.
2. Gutter Profile: Style B in accordance with SMACNA's "Architectural Sheet Metal Manual."
3. Corners: Factory mitered and soldered.
4. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.

C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Zinc-Coated Steel: Nominal 0.034-inch thickness.

D. Zinc-Coated Steel Finish: Two-coat fluoropolymer .

1. Color: Match Architect's sample .

2.4 REGLETS AND COUNTERFLASHINGS

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

1. Fry Reglet Corporation.
2. Heckmann Building Products, Inc.
3. Metal-Era, Inc.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
2. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.

D. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Zinc-Coated Steel Finish: Two-coat fluoropolymer .

1. Color: As selected by Architect from manufacturer's full range .

2.5 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329.

B. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.7 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. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Galvanized-Steel Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755/A755M and coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

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. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet 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 wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws 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 INSTALLATION OF ROOF-EDGE SPECIALITIES

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 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

A. Install components to produce a complete roof-edge drainage system in accordance with manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.

1. Connect downspouts to underground drainage system indicated.

3.5 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

A. Coordinate installation of reglets and counterflashings with installation of base flashings.

3.6 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 07 7100

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof hatches.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 07 6200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

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.

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.

B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories 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 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories to 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. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design roof curbs and to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind-Restraint Performance: As indicated on Drawings .

2.2 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated single -walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

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

a. Babcock-Davis.
b. BILCO Company (The).
c. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
d. Nystrom, Inc.
e. O'Keeffe's Inc.

B. Type and Size:

1. Single-leaf lid, 36 by 36 inches .

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material, Aluminum:

1. Thickness: Manufacturer's standard thickness for hatch size indicated .
2. Finish: Mill Finish .

E. Construction:

1. Insulation: 2-inch- thick, polyisocyanurate board.

a. R-Value: 12.0 according to ASTM C1363.

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. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
5. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

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.

G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: Steel tube .
4. Post: 1-5/8-inch- diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat .

a. Color: As selected by Architect from manufacturer's full range .

2.3 METAL MATERIALS

A. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.

B. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

C. Steel Pipe: ASTM A53/A53M, galvanized.

2.4 MISCELLANEOUS MATERIALS

A. 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 C1289, 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 AWPA C2; not less than 1-1/2 inches thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Underlayment:

1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

G. 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.

H. Elastomeric Sealant: ASTM C920, 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.

I. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

J. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

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.

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. 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 aluminum 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. Attach ladder-assist post according to manufacturer's written instructions.

D. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 9113 "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 07 7200

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

B. Related Requirements:

1. Section 32 1373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type 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.

D. 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.

1.3 INFORMATIONAL SUBMITTALS

1.4 CLOSEOUT SUBMITTALS

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

1.6 MOCKUPS

A. 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.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
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.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Adfast.
b. Pecora Corporation.
c. Sika Corporation - Building Components.
d. Tremco Incorporated.

C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Adfast.
b. Pecora Corporation.
c. Sika Corporation - Building Components.
d. The Dow Chemical Company.
e. Tremco Incorporated.

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

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

a. Adfast.
b. Master Builders Solutions; brand of MBCC Group.
c. Pecora Corporation.
d. Sika Corporation - Building Components.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Adfast.
b. Pecora Corporation.
c. Sika Corporation - Building Components.
d. The Dow Chemical Company.
e. Tremco Incorporated.

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Pecora Corporation.
b. Sika Corporation - Building Components.

2.7 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, undefined:

a. Adfast.

b. Pecora Corporation.
c. Tremco Incorporated.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

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

a. Adfast.
b. Construction Foam Products; a division of Nomaco, Inc.
c. Master Builders Solutions; brand of MBCC Group.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Exterior insulation and finish systems.
    d. .

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. Porcelain enamel.
    c. Glazed surfaces of ceramic tile.
    d. .

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 C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with 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 in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 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.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard hollow-metal doors and frames.
2. Exterior standard hollow-metal doors and frames.

B. Related Requirements:

1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

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

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.5 ACTION SUBMITTALS

A. Product Data:

1. Interior standard hollow-metal doors and frames.
2. Exterior standard hollow-metal doors and frames.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, and finishes.

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.

D. Product Schedule: For hollow-metal doors and frames, 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 CLOSEOUT SUBMITTALS

1.7 QUALITY ASSURANCE

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames 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 HOLLOW METAL DOORS AND FRAMES

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

1. Ceco Door; AADG, Inc.; ASSA ABLOY.
2. Curries, AADG, Inc.; ASSA ABLOY Group.
3. Mesker Door; Mesker Openings Group.
4. Republic Doors and Frames; a Allegion brand.
5. Steelcraft; Allegion plc.

2.2 PERFORMANCE REQUIREMENTS

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule on Drawings .

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.

b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 2, Seamless.
e. Core: Polyurethane Vertical steel stiffener.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime .

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule on Drawings .

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Polyisocyanurate .

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime .

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Glazing: Comply with requirements in Section 08 8000 "Glazing."

2.7 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.8 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 ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 .

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.

5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. 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.
7. Installation Tolerances: Adjust hollow-metal frames 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 and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 .
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 REPAIR

A. 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.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish in accordance with manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 1113

SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.

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.

1.3 INFORMATIONAL SUBMITTALS

1.4 CLOSEOUT SUBMITTALS

1.5 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges (AD) :

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

   a. ACUDOR Products, Inc.
   b. Babcock-Davis.
   c. Milcor by Duravent; Duravent Group.
   d. Nystrom, Inc.

2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Optional Features: Piano hinges .
4. Locations: Ceiling as shown on Reflected Ceiling Plans.
5. Door Size: 12 inches x 12 inches .
6. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch , 16 gage factory primed .
7. Frame Material: Same material and thickness as door .
8. Latch and Lock: Cam latch, screwdriver operated with interior release.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or metallic coating.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

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.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 3113

SECTION 08 3250 - BULLET-RESISTANT SECURITY ALUMINUM WINDOWS, DOORS AND FRAMES (ALTERNATE NO. 4)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: This section includes interior aluminum framed bullet resistant doors, frames, and openings as part of Alternate No. 4.

B. Related Requirements:

1. Section 01 2300 “Alternates”
2. Section 08 7100 “Door Hardware”
3. Section 08 7113 “Power Door Operators.”
4. Section 08 8000 “Glazing.”

1.2 SYSTEM PREFORMANCE REQUIREMENTS

A. Ballistics-Resistance Performance: Provide units identical to those tested for compliance with requirements indicated,and are Listed and labeled as bullet resisting according to UL 752, Level 5 bullet resistance.

B. Forced- Entry-Resistance Performance: Provide units identical to those tested for forced-entry resistance according to HPW-TP-0500.03 or ASTM D 1233 by a testing agency acceptable to authorities having jurisdiction.

C. Design: Frames shall be of the "non-ricochet type" design that is intended to permit the encapture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration. The encapturing barrier shall be UL-listed bullet resistant composite. Frames must utilize a UL-listed internal ballistic protection barrier.

D. Glazing details shall permit glass replacement after initial construction, shall permit use/reuse of original gaskets, shall permit replacement glass of the same nominal size as original glass, and shall not require cutting of framing members or removal of interior finishes. Vision glass in conventional frames shall be replaceable from the interior.

E. Interior window sill trim shall not deflect more than 0.125 inch when subjected to a concentrated force of 25 pounds at any point. Residual deflection after removal of force shall not exceed 0.062 inch.

F. Snap engaged components shall not disengage when subjected to a concentrated force of 10 pounds at any point or during uniform pressure structural tests at pressures less than or equal to 1.5 times design pressures. Snap engaged components shall be secured against migration. Snap engaged components shall not serve any primary structural function, such as retention of glass or panels. Snap engaged plastic components are not permitted, except as nonstructural thermal improvement for interior trim. Joints in continuous snap covers and other continuous trim shall have splice sleeves of the same material and finish as the cover or trim.

G. Provide completely prefabricated, assembled and shop glazed unitized components to the field for shortest possible field erection time.

1.3 INFORMATIONAL SUBMITTALS

A. Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each bullet resistant product indicated, including data on finishes, hardware, accessories, and maintenance recommendations

C. Shop Drawings for each bullet resistant product indicated, including:

D. Layout and installation details, including relationship to adjacent work.

E. Elevations at 1/4 inch scale.

F. Detail sections of typical composite members.

G. Anchors and reinforcements. Hardware mounting heights. Provisions for expansion and contraction. Glazing details.

H. Hardware Schedule: Submit complete hardware schedule organized into sets based on hardware specified in Division 8 Sections. Coordinate hardware with doors, frames and related work to ensure proper size, thickness, hand, function, and finish. Include item name, name of the manufacturer and complete designations of every item for each door opening.

I. Test Reports: Provide certified test reports from a qualified independent testing laboratory showing that bullet resistant aluminum doors and frames have been tested in accordance with specified test procedures and comply with performance characteristics indicated.

1.4 Quality Assurance

A. Installer qualifications: Engage an experienced installer who has completed installations of bullet resistant aluminum doors and frames similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator qualifications: Provide bullet resistant doors and frames fabricated by a firm experienced in producing systems that are similar to those indicated for this project, and that have a record of successful in-service performance. The fabricator shall have sufficient production capacity to produce components required without causing delay in progress of the work.

C. Single source responsibility: obtain bullet resistant aluminum doors and frames from one source and from a single manufacturer.

D. Testing agency qualifications: qualified according to ASTM E 699 and experienced in ballistics and forced-entry resistance testing.

E. 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."
3. AWS D1.6, "Structural Welding Code Stainless Steel."

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver bullet resistant aluminum doors and frames in the manufacturer's original protective packaging.

B. Store bullet resistant aluminum components in a clean, dry location away from uncured masonry or concrete. Cover components with waterproof paper, tarpaulin, or polyethylene sheeting in a manner to permit circulation of air.

C. Stack framing components in a manner that will prevent bending and avoid significant or permanent damage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check openings by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the work.

B. Where necessary, proceed with fabrication without field measurements and coordinate fabrication tolerances to ensure proper fit.

1.7 WARRANTY

A. Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. failures include, but are not necessarily limited to: structural failures including excessive deflection, excessive leakage or air infiltration.

1. Faulty operation.
2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: FIve (5) years after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Insulgard Security Products;www.insulgard.com.

1. Bullet Resistant Door Frame: TH600 Framing System.
2. Bullet Resistant Door: HP 500 Door System with BALULN32 IGU Glass-clad polycarbonate, UL 752 Level 5 rating.

B. Subject to compliance with requirements, provide comparable products by the following:

1. Republic Door and Frames; 5430 FAA Boulevard, Suite 100, Irving, TX 76031; (800) 733.3667, www.republicdoor.com.
2. Total Security Solutions; 935 Garden lane, Fowlerville, MI, 48836; (888) 629.6247, www.security.tssbulletproof.com

2.2 MATERIALS

A. Aluminum Members: All aluminum extrusions shall be extruded from 6063-T6 alloy or equal with aluminum tensile strength (minimum 35.0 ksi ultimate, 32.0 ksi yield).

B. Carbon Steel reinforcement of aluminum framing members shall comply with ASTM A 36 for structural shapes, plates and bars, ASTM A 611 for cold rolled sheet and strip, or ASTM A 570 for hot rolled sheet and strip.

C. Setting blocks: Setting blocks shall be dense extruded silicone or epdm with a hardness of 85 +/5 durometer shore a, a minimum length of 4 inches, and a minimum width corresponding to the glass thickness. Setting blocks shall be equidistant from the glass centerline. Location of setting blocks at glass quarter points is acceptable. The distance from the vertical glass edge to the nearest edge of the setting block shall not be less than six inches or 0.125 times glass width, whichever is greater.

D. Shims used in conjunction with setting blocks shall be of the same material, hardness, length and width as the setting blocks.

E. Setting blocks and chairs shall be secured against migration.

F. Silicone setting blocks are required where structural silicone occurs at the sill.

G. Side Blocks: Provide two side blocks minimum at both jambs at approximately the quarter points of the glass edge. Blocks shall be a 55 +/5 durometer Shore A dense silicone or EPDM. Install block with 0.125 inch (3.2 mm) clearance between block and bearing surface. Positively secure blocks in position. Side blocks may be omitted where glass is secured with structural silicone.

H. Anchors in Concrete: Anchors embedded in concrete shall be prime painted or hot dip galvanized rolled steel, or hot dip galvanized cold formed steel, with integral projections or welded deformed bars or headed studs. Provide expansion bolts in concrete. Self drilling, self threading screws are not acceptable. Screws in plugs and power actuated fasteners are not acceptable.

I. Fasteners: Fastener requirements listed below are applicable to screws, bolts, nuts, washers, rivets, and pins.

1. Fasteners in contact with stone shall be stainless steel type 302 or 304.
2. Fasteners outboard of or within a glazing pocket, finished cavity or other potentially wet location (after completion of construction) shall be stainless steel type 302 or 304. Fasteners inboard of potentially wet locations shall be stainless steel type 302 or 304, cadmium plated carbon steel or zinc plated carbon steel.
3. Provide lock washer or other locking device at all bolted connections.
4. Powder actuated fasteners are not acceptable.
5. Where fasteners screw-anchor into aluminum members less than 0.125 inches thick, reinforce the interior with nonmagnetic stainless steel to receive screw threads. Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat head machine screws that match the finish of member or hardware being fastened.

J. Shims:

1. At connections subject to movement, separate all pairs of moving surfaces with friction reducing pads. Pads shall have minimum 0.125 inch thickness and shall be positively retained in position (open ended slots are not acceptable). Shims which transfer shear forces (tending to slide one shim against another) shall be steel plates, set in a staggered pattern and fillet welded to each other and to the adjacent steel surfaces. The shims and

welds shall be structurally designed to support the applied loads. Plastic shims are acceptable at static connections for which the shims transfer only compressive forces. Wood shims are not acceptable.

K. Sealants: Acceptable products for nonstructural seals to substrates other than stone are:

1. General Electric Sillpruf
2. Dow Corning 790 and 795
3. Tremco Spectrem 1 and 2

L. Acceptable products for structural seals are: Dow Corning 795 and 983; Tremco Proglaze II; GENERAL ELECTRIC SSG 4000 AND SSG 4200.

M. Products requiring mixing of components are acceptable only for shop application with mixing and applicating.

1. Oil base sealants are not acceptable. Sealant Requirements: Comply with the printed instructions and recommendations of the sealant manufacturer regarding joint size limitations, mixing, priming, and application. Unless printed instructions advise to the contrary, do not apply sealants when substrates are wet or when the temperature is below 40 degrees F (4 degrees C).
2. Sealant backup materials shall be polyethylene foam, urethane foam or extruded silicone as recommended by sealant manufacturer. All sealant shall be tooled as a separate operation after application.
3. Coordinate with other sections to assure compatibility of intersecting sealants. Brackets and Reinforcements: Provide high strength nonmagnetic stainless-steel brackets or hot-dip galvanized steel complying with ASTM A 123.

N. Concrete and Masonry Inserts: All internal fasteners shall be 300 Series stainless steel. Framing to building structure shall be grade 5, cadmium or nickel plated. Interior glazing gaskets shall be solid santoprene or EPDM (65-75 Shore A durometer). Exterior glazing gaskets shall be solid santoprene or EPDM (45-65 Shore A durometer).

2.3 HARDWARE

A. Refer to Division 8 Section "Door Hardware" for requirements for hardware items other than indicated to be provided by the bullet resistant aluminum door and frame manufacturer. Provide heavy duty hardware units as indicated, scheduled, or required for operation of each door as specified. Provide positive dead stop at the opening angle standard with the manufacturer for the hold-open angle selected. Provide floor mounted door stop, as specified, with integral rubber bumper; comply with ANSI A156.16, Grade 1.

2.4 COMPONENTS

A. Window, Door and Framing System: Provide system fabricated from extruded aluminum members of 2" x 6" minimum profile indicated. Include subframes and other reinforcing members of the type indicated. Shop fabricate and preassemble frame components.

B. Mullion Configurations: Provide pockets at the inside glazing face to receive specified glazing gaskets. Mullions and horizontals shall be preassembled into pre-glazed units. Make provisions to drain moisture accumulation to the exterior.

C. Provide security entrance door frame assemblies, as indicated, with welded or mechanical joints in accordance with manufacturer's standards. Reinforce as necessary to support required loads.

D. Glass Type: Insulgard Security Products BALULN32 IGU. Level 5 Resistance. Provide hook-in extruded interior aluminum glazing stops, with exterior flanges anchored nonremovable.

1. Tint: Bronze, to match glazing of all other windows and storefront.

E. Lites: Provide bullet resistant glazing openings as indicated, with specified moldings and stops. Provide nonremovable stops on the exterior.

2.5 FABRICATION

A. General: Fabricate security aluminum door and frame components to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes and profile requirements are indicated on the drawings. Variable dimensions are indicated with maximum and minimum dimensions required to achieve design requirements and coordination with other work.

B. Prefabrication: Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the project site. Disassemble components only as necessary for shipment and installation. Typical fixed modules shall be completely prefabricated, shop assembled and shop glazed.

C. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes. Preassemble framing into prefabricated units and shop glaze insofar as practicable.

D. Preglaze door and frame units to greatest extent possible. Typical fixed modules shall be shop glazed.

E. Welding: Comply with AWS recommendations. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish. Welding behind finished surfaces shall be performed in such a manner as to minimize distortion and discoloration on the finished surface.

F. Reinforcing: Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.

G. Dissimilar Metals: Separate dissimilar metals with bituminous paint, or a suitable sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do no use coatings containing lead.

H. Continuity: Maintain accurate relation of planes and angles with hairline fit of contacting members.

I. Uniformity of Metal Finish: Abutting extruded aluminum members shall not have an integral color or texture variation greater than half the range indicated in the sample pair submitted.

J. Fasteners: Conceal fasteners wherever possible. Exposed fasteners shall not be allowed at typical frame conditions.

2.6 ANODIZED ALUMINUM FINISH

A. Anodized finish shall be Aluminum Association Architectural Class I, color coating, 0.017 mm or thicker, complying with AAMA 611.

1. Color: Dark Bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and supports, with the installer present, for compliance with requirements indicated, installation tolerances, and other conditions that affect installation of aluminum entrances and storefronts. Correct unsatisfactory conditions before proceeding with the installation. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Install components in proper alignment and relation to established lines and grades indicated. Provide proper support and anchor securely in place. Construction Tolerances: Install security aluminum doors and frames to comply with the following tolerances:

1. Variation from Plane: Do not exceed 1/8 inch in 12 feet of length or 1/4 inch in any total length. Offset from Alignment: The maximum offset from true alignment between two identical members abutting end to end in line shall not exceed 1/16 inch.
2. Diagonal Measurements: The maximum difference in diagonal measurements shall not exceed 1/8 inch. Offset at Corners: The maximum out-of-plane offset of framing at corners shall not exceed 1/32 inch. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials. Zinc or cadmium plate steel anchors and other unexposed fasteners after fabrication. Paint dissimilar metals where drainage from them passes over aluminum. Paint aluminum surfaces in contact with mortar, concrete or other masonry with alkali resistant coating. Paint wood and similar absorptive material in contact with aluminum and exposed to the elements or otherwise subject to wetting, with two coats of aluminum house paint. Seal joints between the materials with sealant.

B. Drill and tap frames and doors and apply surface mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible. Set sill members and other members in bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weathertight construction.

3.3 ADJUSTING

A. Adjust operating hardware to function properly, for smooth operation without binding, and for weathertight closure.

3.4 CLEANING

A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings. Clean glass surfaces after installation. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.5 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that aluminum security doors and frames will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION 08 3250

SECTION 08 3313 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Counter door assemblies.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for door-opening framing and corner guards.
2. Section 09 9123 "Interior Painting" for finish painting of factory-primed doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, and other accessories.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Bottom bar.
3. Guides.
4. Brackets.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 PERFORMANCE REQUIREMENTS

A. Sound-Control Doors: Assemblies tested in a laboratory for sound-transmission-loss performance according to ASTM E90, calculated according to ASTM E413, and rated for not less than the STC value indicated.

2.3 COUNTER DOOR ASSEMBLY (H1)

A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.

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

a. Alpine Overhead Doors, Inc.
b. C.H.I. Overhead Doors, Inc.
c. Cornell; a CornellCookson company.
d. McKeon Door Company.
e. Overhead Door Corporation.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000 . One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. STC Rating: 26 .

D. Door Curtain Material: Galvanized steel .

E. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.

1. Insulated-Slat Interior Facing: Plastic.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

F. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated stainless steel and finished to match door .

G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

H. Hood: Match curtain material and finish .

1. Shape: Square .
2. Mounting: Face of wall .

I. Sill Configuration: No sill .

J. Locking Devices: Equip door with slide bolt for padlock .

K. Manual Door Operator: Awning-crank operator.

1. Provide operator with manufacturer's standard removable operating arm.

L. Curtain Accessories: Equip door with push/pull handles .

M. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range .
2. Interior Curtain-Slat Facing: PVC plastic .

2.4 MATERIALS, GENERAL

2.5 DOOR CURTAIN MATERIALS AND FABRICATION

A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
3. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of 25 and smoke-developed index of 450, according to ASTM E84 or UL 723.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.6 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.
2. Stainless Steel: 0.025-inch- thick, stainless steel sheet, Type 304, complying with ASTM A240/A240M or ASTM A666.

B. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):

1. Galvanized Steel: Hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

C. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling unless otherwise indicated.

2.7 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

2.8 CURTAIN ACCESSORIES

A. Weatherseals: Equip door with weather-stripping gaskets fitted to entire perimeter of door for air-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene .

B. Astragal: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

C. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.9 COUNTER DOOR ACCESSORIES

2.10 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.11 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25-lbf force to turn crank. Fabricate gearbox to be oiltight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.12 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 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.

2.13 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.4 MAINTENANCE SERVICE

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors.

END OF SECTION 08 3313

SECTION 08 3613 - SECTIONAL DOORS

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. Sectional-door assemblies.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

B. Finish warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with provisions in the U.S. Department of Justice's "2010 ADA Standards for Accessible Design" U.S. Department of Transportation's "ADA Standards for Transportation Facilities" ICC A117.1 applicable to sectional doors.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
e. Delamination of exterior or interior facing materials.

2. Warranty Period: Five years from date of Substantial Completion.

B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Drawings .
2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria .
3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

4. Operability under Wind Load: Design sectional doors to remain operable under design wind load, acting inward and outward.

2.3 SECTIONAL-DOOR ASSEMBLY <Insert drawing designation>

A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

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

a. Amarr; an ASSA ABLOY Group company.
b. Overhead Door Corporation.
c. Raynor Garage Doors.
d. Rite-Hite Holding Corporation.
e. Wayne Dalton; a division of Overhead Door Corporation.

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

D. U-Value: 0.052 Btu/sq. ft. x h x deg F .

E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G60 zinc coating.

1. Door-Section Thickness: 2 inches .
2. Section Faces:

a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.

1) Steel Sheet Thickness: 0.019-inch 0.022-inch nominal coated thickness.
2) Surface: Manufacturer's standard, grooved .

c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:

1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of 0.022 inch or dimension recommended in writing by manufacturer to comply with performance requirements .

3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch nominal coated thickness and welded to door section.
4. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.

    a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
    b. Hardware Locations: Provide reinforcement for hardware attachment.

5. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:

    a. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
    b. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.

F. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings .
3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

    a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle attached to track and wall.
    b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

G. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.

H. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

    a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
    b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

a. Roller-Tire Material: Manufacturer's standard .

3. .

I. Locking Device:

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
2. Chain Lock Keeper: Suitable for padlock.
3. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

J. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.

    a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
    b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.

3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1 .
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

K. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use .
4. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day .
5. Operator Type: Manufacturer's standard for door requirements.
6. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.

    a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec. , without exceeding nameplate ratings or service factor .
    b. Electrical Characteristics:

        1) Phase: Field verify.

2) Volts: Field Verify.

7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

    a. Monitored Entrapment Protection: Photoelectric sensor Electric sensor edge on bottom section designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
    b. Unmonitored Entrapment Protection: .

9. Control Station: Surface mounted, three-position (open, close, and stop) control.

    a. Operation: Push button .
    b. Interior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof-type, NEMA ICS 6, Type 4 enclosure.

10. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf .
11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

L. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

    a. 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 substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 3613

SECTION 08 4313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.

2. Venting Windows in storefront systems.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Installer .

B. Energy Performance Certificates: For aluminum-framed storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed storefront.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals , 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, Factory-Applied Finishes: 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 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. EFCO Corporation.
2. Kawneer Company, Inc.; Arconic Corporation.
3. Manko Window Systems, Inc.
4. Tubelite Inc.
5. YKK AP America Inc.

B. Source Limitations: Obtain all components of aluminum-framed storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings .

C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of 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 .
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 .

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.

D. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures, structural distress, or 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. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. .

F. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

    a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
    b. Venting Windows: Whole window U-factor of not more than 0.43 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.

2. Solar Heat Gain Coefficient (SHGC):

    a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.40 as determined in accordance with NFRC 200.
    b. Venting Windows: Whole window SHGC of not more than 0.40 as determined in accordance with NFRC 200.

3. Air Leakage:

    a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with ASTM E283.
    b. Venting Windows: Whole window air leakage of not more than 0.3 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.
b. Venting Windows: Whole window CRF of not less than 55 as determined in accordance with AAMA 1503.

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F .
b. Low Exterior Ambient-Air Temperature: 0 deg F .
c. Interior Ambient-Air Temperature: 75 deg F .

2.3 ALUMINUM-FRAMED STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken .
2. Glazing System: Retained mechanically with gaskets on four sides .
3. Glazing Plane: Front .
4. Finish: Clear anodic finish Color anodic finish Baked-enamel or powder-coat finish .
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Venting Windows:

1. Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:
   a. Window Type: Awning.
2. Minimum Performance Class: CW.
3. Minimum Performance Grade: 30
4. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
5. Retain applicable hardware types from list below.
   a. Pole-operated, cam handle locking system, where rail is more than 72 inches above floor.
   b. Limit Devices: limit devices designed to restrict sash opening.
   c. Limit clear opening to **6 inches** for ventilation; with custodial key release.
   d. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
   e. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows

1) Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.

f. Glazing: Same as adjacent aluminum-framed entrances and storefront glazing.

g. Finish: Match adjacent aluminum-framed entrances and storefront finish.

2.4 GLAZING

A. Glazing: Comply with Section 08 8000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers. Comply with Section 08 8000 "Glazing."

2.5 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads , finished to match framing system .

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Dead-soft, 0.018-inch- thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

E. Rigid PVC Filler.

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. Provisions for field replacement of glazing from interior .
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using shear-block system screw-spline system .

F. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

1. Color: Dark bronze .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 9200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 8000 "Glazing."

3.5 ERECTION TOLERANCES

A. Install aluminum-framed storefronts to comply with the following 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.

END OF SECTION 08 4313

SECTION 08 5113 - ALUMINUM WINDOWS

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 aluminum windows for exterior locations.

B. Related Requirements:

1. Section 08 4313 "Aluminum-Framed Storefronts" for coordinating finish among aluminum fenestration units.

1.3 PREINSTALLATION MEETINGS

A. 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 and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: For aluminum windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches .

2. Exposed Hardware: Full-size units.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AAMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: CW .
2. Minimum Performance Grade: 30 .

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.35 Btu/sq. ft. x h x deg F .

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30 .

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45 .

2.3 ALUMINUM WINDOWS

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

1. EFCO Corporation.
2. Kawneer Company, Inc.; Arconic Corporation.
3. Manko Window Systems, Inc.
4. OldCastle BuildingEnvelope (OBE).
5. Winco Window Company, Inc.

B. Types: Provide the following types in locations indicated on Drawings:

1. Single hung.
2. Fixed.

C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

D. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.

a. Tint: Bronze .
b. Kind: Fully tempered .

2. Lites: Two .
3. Filling: Fill space between glass lites with air .
4. Low-E Coating: Sputtered on second or third surface .

E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal .

F. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range .

G. Window Hardware:

1. Hinges: Non-friction type, not less than two per sash .

H. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
3. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

I. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

J. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Half, outside for single-hung sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

C. Glass-Fiber Mesh Fabric: 18-by-14 or 18-by-16 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.

1. Mesh Color: Select from Manufacturers full range .

2.6 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" 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.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: As selected by Architect from full range of industry colors and color densities .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08 5113

SECTION 08 7100 - DOOR HARDWARE

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. Mechanical door hardware for the following:

a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Sections:

1. Section 08 1113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Section 08 4313 "Aluminum-Framed Storefronts" for installation of entrance door hardware, including cylinders.

C. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.

1. lock cylinders

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

a. Details of interface of electrified door hardware and building safety and security systems.
b. Risers.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

    a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
    b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    c. Content: Include the following information:

        1) Identification number, location, hand, fire rating, size, and material of each door and frame.
        2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
        3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
        4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
        5) Fastenings and other pertinent information.
        6) Explanation of abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for door hardware.
        8) List of related door devices specified in other Sections for each door and frame.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware schedule.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

C. Means of Egress Doors: Latches do not require more than 15 lb to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lb.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

E. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination." In addition to Owner Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.8 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

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 products equivalent in function and comparable in quality to named 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.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames. Provide template-produced hinges for hinges installed in aluminum doors and frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ABH
   b. Allegion plc.
   c. Design Hardware.
   d. Hager Companies;.
   e. McKinney Products Company; an ASSA ABLOY Group company.
   f. Stanley Commercial Hardware; a division of Stanley Security Solutions; Div. of The Stanley Works.

2.3 PUSH/PULL HANDLES

1. Stainless Steel

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allegion plc.
   b. Design Hardware.
   c. National Guard Products, Inc.
   d. Pemko Manufacturing Co.
   e. Zero International, Inc.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latch bolt throw.
2. Deadbolts: Minimum 1.25-inch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latch bolt 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.

1. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

E. Bored Locks: BHMA A156.2; Grade 1; Series 4000.

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

   a. Best Access Systems; Stanley Security Solutions, Inc. (Best Preferred Patented Cores is the only allowable lockset – no substitutions.)

2.5 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

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

a. Allegion plc.
b. Precision Hardware, Inc.; a Stanley company.
c. SARGENT Manufacturing Company; ASSA ABLOY.
d. Yale Security Inc; an ASSA ABLOY Group company.

2.6 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.

a. Best Access Systems; Stanley Security Solutions, Inc.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.

C. High-Security Lock Cylinders: BHMA A156.30; Grade 1; Type M, mechanical; permanent cores that are removable; face finished to match lockset.

D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Existing System:

a. Master key or grand master key locks to Owner's existing system.

2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Owner.

2.8 ACCESSORIES FOR PAIRS OF DOORS

A. Astragals: BHMA A156.22.

1. Overlapping T with block gasket

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

    a. DORMA Architectural Hardware; Member of The DORMA Group North America.
    b. LCN Closers; an Ingersoll-Rand company.
    c. Norton Door Controls; an ASSA ABLOY Group company.

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. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

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

    a. DORMA Architectural Hardware; Member of The DORMA Group North America.
    b. LCN Closers; an Ingersoll-Rand company.
    c. Norton Door Controls; an ASSA ABLOY Group company.

2.10 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.

2.11 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hager Companies;.
    b. National Guard Products, Inc.
    c. Pemko Manufacturing Co.
    d. Zero International, Inc.

2.12 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. METAL Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. National Guard Products, Inc.
    b. Pemko Manufacturing Co.
    c. Zero International, Inc.

2.13 FABRICATION

A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

B. 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. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.14 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.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. 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. 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.

C. 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 of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

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. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 9200 "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.

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. Thresholds: Miter and return at projecting ends beyond jamb and mullion.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

Group 1 (Doors 102, 103, 104, 108)

1 ½ pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Closer	4040XP x x Alumn.	LCN
1 ea.	Entrance	93K-7-AB-14D-S3 x 626	Best
1 ea.	Wall Stop	409 x 626	Rockwood
1 ea.	Threshold	573x5FG 36”	Pemko

Group 2 (Doors 124, 125)

1 ½ pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Entrance	93K-7-AB-14D-S3 x 626	Best
1 ea.	Wall Stop	409 x 626	Rockwood

Group 3 (Doors 106, 107, 121A, 126)

1 ½ pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Closer	4040XP x x Alumn.	LCN
1 ea.	Classroom	93K-7-R-14D-S3 x 626	Best
1 ea.	Wall Stop	409 x 626	Rockwood
1 ea.	Threshold	573x5FG 36”	Pemko

Group 4 (Doors 123)

1 ½ pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Classroom	93K-7-R-14D-S3 x 626	Best
1 ea.	Wall Stop	409 x 626	Rockwood

Group 5 (Doors 105)

3 pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
2 ea.	Closer	4040XP x x Alumn.	LCN
1 ea.	Coordinator	COR x 52 x US28 x 36	IVES
1 ea.	Astragal	375 R 84 C	Pemko
1 ea.	Classroom	93K-7-R-14D-S3 x 626	Best
1 ea.	Dummy	93K-7-1DT-14D-S3 x 626	Best
2 ea.	Flush Bolt	262 x B26D	IVES
1 ea.	Threshold	573x5FG 72”	Pemko

Group 6 (Doors 113)

3 pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
2 ea.	Closer	4040XP x x Alumn.	LCN
1 ea.	Coordinator	COR x 52 x US28 x 36	IVES
1 ea.	Astragal	375 R 84 C	Pemko
1 ea.	Classroom	93K-7-R-14D-S3 x 626	Best
2 ea.	Flush Bolt	262 x B26D	IVES
1 ea.	Wall Stop	409 x 626	Rockwood
1 ea.	Threshold	573x5FG 72”	Pemko

Group 7 (Doors 111)

3 pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
2 ea.	Closer	4040XP x x Alumn.	LCN
1 ea.	Coordinator	COR x 52 x US28 x 36	IVES
1 ea.	Astragal	375 R 84 C	Pemko
1 ea.	Storeroom	93K-7-D-14D-S3 x 626	Best
1 ea.	Dummy	93K-7-1DT-14D-S3 x 626	Best
2 ea.	Flush Bolt	262 x B26D	IVES
1 ea.	Wall Stop	409 x 626	Rockwood
1 ea.	Threshold	573x5FG 60”	Pemko

Group 8 (Doors 112)

3 pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
2 ea.	Closer	4040XP x x Alumn.	LCN
1 ea.	Coordinator	COR x 52 x US28 x 36	IVES
1 ea.	Astragal	375 R 84 C	Pemko
1 ea.	Storeroom	93K-7-D-14D-S3 x 626	Best
1 ea.	Dummy	93K-7-1DT-14D-S3 x 626	Best
2 ea.	Flush Bolt	262 x B26D	IVES
1 ea.	Threshold	573x5FG 60”	Pemko

Group 9 (Doors 119)

1 ½ pr.	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Closer	4040XP x x Alumn.	LCN
1 ea.	Privacy	93K-0-L-14D-S3 x 626	Best
1 ea.	Threshold	573x5FG 36”	Pemko

Group 10 (Doors 116, 122)

1 ½ pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Closer	4040XP x Alumn.	LCN
1 ea.	Storeroom	93K-7-D-14D-S3 x 626	Best
1 ea.	Threshold	573x5FG 36”	Pemko

Group 11 (Door 114, 118)

1 ½ pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Closer	4040XP x x Alumn	LCN
1 ea.	Pull Plate	110 x 70C 4x16 630	Rockwood
1 ea.	Push Plate	70F 8x16x.050 630	Rockwood
1 ea.	Threshold	573x5FG 36”	Pemko

Group 12 (Door 100B)

3 pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
2 ea.	Closer	4040XP x Alumn	LCN
2 ea.	Pull Plate	110 x 70C 4x16 630	Rockwood
2 ea.	Push Plate	70F 8x16x.050 630	Rockwood
1 ea.	Threshold	573x5FG 72”	Pemko

Group 13 (Door 101)

1 ½ pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Closer	416 x Heavy Duty HO Arm x AL	Design Hdwr
1 ea.	Panic/Storeroom	ED5200-N959ET-630	Corbin Russwin
1 ea.	cylinder		
1 ea.	Sweeps	770S x D	Hager
1 set	Weatherseal	700N	Nat. Guard
1 ea.	Rain Cap	810S x D	Hager
1 ea.	Latch Protector	341D x 630	Hager
1 ea.	Threshold	256x6A x width of door	Pemko

Group 14 (Door 121, CS101)

1 ½ pr	Butts	BB1168 x 4 ½ x 4 ½ x 626	Hager
1 ea.	Closer	416 x Heavy Duty HO Arm x AL	Design Hdwr
1 ea.	Storeroom	93K-7-D-14D-S3 x 626	Best
1 ea.	cylinder		
1 ea.	Sweeps	770S x D	Hager
1 set	Weatherseal	700N	Nat. Guard
1 ea.	Rain Cap	810S x D	Hager
1 ea.	Latch Protector	341D x 630	Hager
1 ea.	Threshold	256x6A x width of door	Pemko

Group 15 (Door 100A)

2 ea.	Cont. Hinge	A240HD x DKB	ABH
1 ea.	Panic	2103CD x 630	Precision
1 ea.	Elect Panic	ELR 2103CD x 630	Precision
1 ea.	Rem Mull	KR4954 dark bronze	VD
1 ea.	Power Transfer	EPT-10 x 689	VD
2 ea.	Pull Handle	8190HDEZ-0 X 630	IVES
1 ea.	Auto Operator	per Power Door Operator Specification	
2 ea.	Closer Device	4040XP HCUSH x 689	LCN
1 ea.	Drop Plate	4040XP-18PA x 689	LCN
1 ea.	Bladestop SPC	4040XP-30 x 626	LCN
1 ea.	Shoe Support	4040XP-61 x 626	LCN
1 ea.	Mortise Cyl		BEST
1 ea.	RimCyl		BEST
1 ea.	Power Supply	EL-151	Precision
1 ea.	Threshold	Door Manufacturer Standard	
2 ea.	Door Seals	Door Manufacturer Standard	
2 ea.	Door Sweep	Door Manufacturer Standard	

END OF SECTION 08 7100

SECTION 08 7113 - POWER DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Low-energy door operators for swinging doors.

2. Replacement of existing door operators.

B. Related Requirements:

1. Section 08 7100 "Door Hardware" for access control components.

1.2 DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.

C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.

D. For automatic door terminology, see BHMA A156.19 for definitions of terms.

1.3 COORDINATION

A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control power door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.

B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing power door operators.

C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.

D. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to the following:

1. Power supplies.
2. Access-control system.

E. Pneumatic System Roughing-in: Coordinate layout and installation of power door operators and power units with compressed-air piping.

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, dimensions of individual components and profiles, and finishes for power door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For power door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.
5. Include plans, elevations, sections, and attachment details for guide rails.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer .

B. Product Certificates: For each type of power door operator.

C. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For power door operators, safety devices, and control systems, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project and who employs a Certified Inspector.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of power door operators that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty or sporadic operation of power door operator, including controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Provide Dormakaba USA Inc., ED 250 Model automatic door operator for ballistic doors, or subject to compliance with requirement, compatible product by one of the following:

1. ASSA ABLOY Entrance Systems; ASSA ABLOY.
2. NABCO Entrances, Inc.
3. record-usa.
4. STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.

B. Source Limitations: Obtain power door operators, including activation and safety devices, from single source from single manufacturer.

2.2 POWER DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.

B. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.

C. Cover for Surface-Mounted Operators: Fabricated from 0.125-inch- thick, extruded or formed aluminum ; continuous over full width of operator-controlled door opening ; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.

D. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment-Prevention Force: Not more than 15 lbf required to prevent stopped door from closing or opening.

C. Configuration, Single: Operator to control single swinging door.

1. Traffic Pattern: Two way.

2. Operator Mounting: Surface .

D. Operation: Power opening and spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.

E. Operating System: Electromechanical .

F. Microprocessor Control Unit: Solid-state controller.

G. Features:

1. Adjustable opening and closing speed.
2. Adjustable opening and closing force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Obstruction recycle.
8. On-off/hold-open switch to control electric power to operator ; key operated.

H. Activation Device: to activate door operator:

1. Interior: Push-plate switch.
2. Exterior: Keypad input device.

I. Exposed Finish: Class I, color anodic finish Finish matching door and frame .

1. Color: As selected by Architect from full range of industry colors and color densities .

2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extrusions: ASTM B221.
2. Sheet: ASTM B209.

B. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.5 CONTROLS

A. General: Provide controls, including activation and safety devices, in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.

B. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.

C. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator with contrasting-colored, engraved message.

1. Configuration:

a. Square push plate with 4-by-4-inch junction box.

1) Mounting: Surface mounted on wall.

2. Push-Plate Material: Stainless steel as selected by Architect from manufacturer's full range.
3. Message: International symbol of accessibility and "Push to Open."

D. Keypad Switch: Push button keypad input device with Braille and audio feedback

1. Configuration:

a. Mounting: Surface mount 3" x 4.5" device with 5" x 5" stainless steel cover plate at existing j-box.

2. Material: Stainless Steel housing and keypad suitable for exterior use - relative humidity 5% - 95%, non-condensing.

2.6 ACCESSORIES

A. Signage: As required by cited BHMA standard for type of door and its operation.

1. Application Process: Operator manufacturer's standard process .
2. Provide sign materials with instructions for field application when operators are installed.

2.7 FABRICATION

A. Factory fabricate power door operators to comply with indicated standards.

B. Form aluminum shapes before finishing.

C. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure to the exterior.

D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.

E. Provide metal cladding, completely covering visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.8 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary, protective covering before shipping.

B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of power door operators.

B. Examine roughing-in for electrical systems to verify actual locations of power connections before power door operator installation.

C. Examine roughing-in for compressed-air piping systems to verify actual locations of piping connections before power door operator installation.

D. Verify that full-height finger guards are installed at each door with pivot hinges, where door has a clearance at hinge side greater than 1/4 inch and less than 3/4 inch with door in any position.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install power door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.

1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.

B. Controls: Install activation and safety devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring in accordance with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

C. Access-Control System: Connect operators to access-control system as specified in Section 28 1500 "Access Control Hardware Devices."

D. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.

3.3 ADJUSTING

A. Adjust power door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.

1. Adjust operators on exterior doors for tight closure.

B. After completing installation of power door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.

C. Readjust power door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

D. Occupancy Adjustment: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power door operators.

END OF SECTION 08 7113

SECTION 08 8000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing tapes.
4. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 08 3250 “Bullet-Resistant Security Aluminum Windows, Doors and Frames.”
2. Section 08 5113 “Aluminum Windows.”
3. Section 08 8300 "Mirrors."
4. Section 08 8853 “Security Glazing.”

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 in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass the following products; 12 inches square.

1. Insulating glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturers of fabricated glass units .

B. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to 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. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings .

    a. Wind Design Data: As indicated on Drawings.
    b. Basic Wind Speed: 110 mph .
    c. Importance Factor: 1.0 .
    d. Exposure Category: C .

2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. 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 6 mm thick .
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm .
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Aluminum with bronze, color anodic finish .
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 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 C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as 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.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by 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:

1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

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.

G. 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 in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 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 Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket 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. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.6 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type (GL-1) : Fully tempered float glass.

1. Minimum Thickness: 6 mm .
2. Safety glazing required.

3.7 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Tinted Insulating Glass Type (GL-2) :

1. Basis-of-Design Product: Vitro Architectural Glass; Solarban 60 Solarbronze .
2. Overall Unit Thickness: 1 inch .
3. Minimum Thickness of Each Glass Lite: 6 mm .
4. Outdoor Lite: Tinted fully tempered float glass.
5. Tint Color: Bronze .
6. Interspace Content: Air .
7. Indoor Lite: Clear annealed float glass.
8. Low-E Coating: Pyrolytic or sputtered on second or third surface.
9. Winter Nighttime U-Factor: 0.29 maximum.
10. Summer Daytime U-Factor: 0.27 maximum.
11. Visible Light Transmittance: 42 percent minimum.
12. SGHC: 0.28 maximum.
13. Safety glazing required.

END OF SECTION 08 8000

SECTION 08 8300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Silvered flat glass mirrors.

B. Related Requirements:

1. Section 10 2800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

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.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with 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.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.5 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.

1. Warranty Period: Five years from date of Substantial Completion .

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

B. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C1503.

B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear .

1. Nominal Thickness: 6.0 mm .

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.

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. Aluminum J-Channel Bottom and Side 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 0.04 inch.

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

1) Andscot Company, Inc.
2) C.R. Laurence Co., Inc.; CRH Americas, Inc.
3) Stylmark, Inc.

2. Aluminum J-Channel 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 0.04 inch.

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

1) Andscot Company, Inc.
2) C.R. Laurence Co., Inc.; CRH Americas, Inc.
3) Stylmark, Inc.

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. Shop fabricate mirrors 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 National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. NGA Publications: "Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass 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 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.

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.

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 and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 08 8300

SECTION 08 8853 - SECURITY GLAZING (ALTERNATE NO. 4)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Insulating security glazing as part of Alternate No. 4.

B. Related Requirements:

1. Section 01 2300 “Alternates.”

2. Section 08 3250 "Bullet-Resistant Security Aluminum Windows, Doors And Frames."

1.2 DEFINITIONS

A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.

B. Interspace: Space between lites of air-gap security glazing or insulating security glazing.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification:

1. Glazing: Actual sample of finished products for each type of security glazing.

a. Size: Manufacturers' standard size .

2. Glazing Accessories: Actual sample of sealants and colored spacers . Install sealant Samples between two strips of material representative in color of the adjoining framing system.
3. Size: Manufacturers' standard size .

C. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports:

a. For each type of security glazing, for tests performed by qualified testing agency .
b. For each type of glazing sealant, for tests performed by a qualified testing agency.

1) Provide test reports based on testing current sealant formulations within previous 36-month period.

B. Qualification Statements: For installers glazing testing agency and sealant testing agency.

C. Sample warranties.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: For insulating or air-gap security glazing units with sputter-coated, low-e coatings, a qualified insulating glazing manufacturer who is approved and certified by coated-glass manufacturer.
2. Installers: Fabricator of products Entity that employs installers and supervisors who are trained and approved by manufacturer .
3. Security Glazing Testing Agency: Subject to compliance with requirements, testing agency is one of the following:

a. Intertek.
b. Underwriters Laboratories, Inc.
c. Wiss, Janney, Elstner Associates, Inc.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Special Warranty, Insulating Security Glazing: Manufacturer agrees to replace insulating security glazing that fails in materials and workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Defects in individual lites developed from normal use or failure of hermetic seal under normal use. Defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning insulating security glazing contrary to manufacturer's written instructions are not included.
b. Defects in coated-glass lites include peeling, cracking, and other indications of deterioration in coating.
c. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
d. Defects in glass-clad polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
e. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of security glazing from single source from single manufacturer.

1. Obtain glass from single source from single manufacturer.

B. Obtain glazing sealants and gaskets from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General:

1. Installed security glazing will withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
2. Installed security glazing will withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design security glazing.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

D. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 SECURITY GLAZING, GENERAL

A. Glazing Publications: Comply with published recommendations of security glazing and glazing material 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. AAMA Publications: AAMA GDSG-1 and AAMA TIR-A7.
2. IGMA Publication for Sloped Glazing: IGMA TB-3001.
3. IGMA Publication for Insulating Glass: SIGMA TM-3000.
4. NGA Publications: "Laminated Glazing Reference Manual" and "GANA Glazing Manual."

B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

C. Insulating Glazing Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.

D. Fire-Test-Response Characteristics of Polycarbonate Sheets: As determined by testing polycarbonate sheets identical to those used in security glazing products by a qualified testing agency acceptable to authorities having jurisdiction.

1. Self-ignition temperature of 650 deg F or more when tested in accordance with ASTM D1929 on plastic sheets in thicknesses indicated for the Work.
2. Smoke-Developed Index of 450 or less when tested in accordance with ASTM E84 or UL 723, or smoke density of 75 or less when tested in accordance with ASTM D2843 on plastic sheets in thicknesses indicated for the Work.
3. Burning extent of 1 inch or less when tested in accordance with ASTM D635 at a nominal thickness of 0.060 inch or thickness indicated for the Work.

E. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on construction products indicated and on procedures indicated below:

1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW 7.7 computer program.
3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.4 GLASS PRODUCTS

A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. For fully tempered float glass, comply with requirements for Kind FT.
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. Chemically Strengthened Glass: Annealed float glass is chemically strengthened to comply with ASTM C1422/C1422M, Surface Compression Level 2 and Case Depth Level B .

2.5 INSULATING SECURITY GLAZING

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

1. Dlubak Specialty Glass Corporation; Consolidated Glass Holdings, Inc.
2. Global Security Glazing; Consolidated Glass Holdings, Inc.
3. McGrory Glass, Inc.
4. Viracon, Inc.

B. Insulating Security Glazing: Factory-assembled units, consisting of sealed lites of glazing material indicated separated by a dehydrated interspace, qualified in accordance with ASTM E2190

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Polypropylene-covered stainless steel in color selected by Architect .
3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, 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 security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of Industry colors.

B. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested in accordance with ASTM C661.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and security glazing manufacturers for application indicated; and complying with ASTM C1281 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.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of security glazing 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:

1. EPDM with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.
2. Type recommended in writing by sealant or security glazing manufacturer.

E. Edge Blocks:

1. EPDM with Shore A durometer hardness in accordance with manufacturer's written instructions.
2. Type recommended in writing by sealant or security glazing manufacturer.

2.9 FABRICATION OF SECURITY GLAZING

A. Fabricate security glazing 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. Grind smooth and polish exposed security glazing edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing for security glazing, 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 system.
3. Minimum required face or edge clearances.
4. Minimum required bite.
5. Effective sealing between joints of framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving security glazing 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 security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of it off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. 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 performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness of slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and in accordance with requirements in referenced glazing publications.

H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers, or spacers and backings, in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from security glazing.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine security glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.

C. Wash security glazing on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

3.6 INSULATING SECURITY GLAZING SCHEDULE

A. Security Glazing Type SG-1: Clear insulating security glazing . Outdoor lite is made of monolithic glass, and indoor lite is made of glass-clad polycarbonate.

1. Basis-of-Design Product: Subject to the requirements, provide: Insulgard Security Products; Armor-Guard BALULN32-IG, Glass-Clad Polycarbonate, UL752 Level 5 .
2. Overall Unit Thickness: 2.0 Inches .
3. Outdoor Lite: Fully tempered float glass.
4. Indoor Lite: Glass-clad polycarbonate.

    a. Outer Ply: 6 mm fully tempered float glass.
    b. Multiple Core:

        1) Outer Core Ply: 0.118-inch polycarbonate.
        2) Double Inner Core Plies : 0.118-inch polycarbonate.

    c. Inner Ply: 6 mm heat-strengthened float glass.

5. Interspace Content: Air .
6. Interspace Dimension: 0.5 Inch .
7. Overall Visible Light Transmittance: 70 percent minimum.
8. Outdoor Visible Reflectance: 15 percent maximum.
9. Winter Nighttime U-Factor: 0.85 maximum.
10. Summer Daytime U-Factor: 0.82 maximum.

11. Solar-Heat-Gain Coefficient: 45 maximum.
12. Provide safety glazing labeling.

END OF SECTION 08 8853

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing systems.
2. Grid suspension systems.

B. Related Requirements:

1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Framing systems.
2. Grid suspension systems.

1.3 INFORMATIONAL SUBMITTALS

1.4 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

B. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

C. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.

2.2 FRAMING SYSTEMS

A. Studs and Track: ASTM C645 .

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

    a. ClarkDietrich.
    b. Marino\WARE.
    c. SCAFCO Steel Stud Company; Stone Group of Companies.
    d. Telling Industries.

2. Minimum Base-Steel Thickness: As indicated on Drawings.
3. Depth: As indicated on Drawings .

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement.
2. Single Long-Leg Track System: Top track with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
3. Deflection Track: Steel sheet top track 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. Hat-Shaped, Rigid Furring Channels:

1. Minimum Base-Steel Thickness: 0.0329 inch.
2. Depth: As indicated on Drawings.

2.3 GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Armstrong Ceiling & Wall Solutions.
    b. CertainTeed; SAINT-GOBAIN.
    c. USG Corporation.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLATION OF FRAMING SYSTEMS

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: As required by horizontal deflection performance requirements 24 inches o.c. unless otherwise indicated.
2. Tile Backing Panels: As required by horizontal deflection performance requirements 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install 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. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. 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.

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.

3.5 INSTALLATION OF GRID SUSPENSION SYSTEMS

A. 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.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Abuse-resistant gypsum board.
3. Mold-resistant gypsum board.
4. Glass-mat, water-resistant backing board.
5. Cementitious backer units.
6. Interior trim.
7. Joint treatment materials.
8. Sound-attenuation blankets.
9. Acoustical sealant.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.3 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.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install 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.

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 in accordance with ASTM E119 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

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

    a. American Gypsum.
    b. CertainTeed; SAINT-GOBAIN.
    c. Georgia-Pacific Gypsum LLC.
    d. Gold Bond Building Products, LLC provided by National Gypsum Company.
    e. USG Corporation.

2. Thickness: 5/8 inch.
3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.

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

    a. CertainTeed; SAINT-GOBAIN.
    b. Georgia-Pacific Gypsum LLC.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company.
    d. USG Corporation.

2. Core: 5/8 inch , Type X.
3. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
4. Indentation: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
5. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

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

    a. CertainTeed; SAINT-GOBAIN.
    b. Georgia-Pacific Gypsum LLC.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company.
    d. USG Corporation.

2. Core: 5/8 inch , Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.4 SPECIALTY GYPSUM BOARD

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

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

    a. C-Cure.
    b. PermaBASE Building Products, LLC provided by National Gypsum Company.
    c. USG Corporation.

2. Thickness: 1/2 inch .
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Plastic or Paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. L-Bead: L-shaped; exposed long flange receives joint compound.
    d. Expansion (control) joint.
    e. Base-of-Wall Galvanized Moisture Barrier Trim: Galvanized-steel sheet, 2 inches high.

        1) Manufacturers: Subject to compliance with requirements, provide products by the following:

            a) VersaDry, LLC.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints , rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping 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. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 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 C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch 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. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. 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.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical surfaces unless otherwise indicated .
2. Abuse-Resistant Type: As indicated on Drawings .
3. Glass-Mat Interior 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) 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-shaped 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.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated on Drawings locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF 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 in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.

3.6 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated on drawings.
2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated

a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

3. Level 5: Where indicated on Drawings

a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

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 09 2900

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes 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. Acoustical Ceiling Units: Full-size panels equal to 5 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 5 percent of quantity installed.
3. Hold-Down Clips: Equal to 5 percent of quantity installed.
4. Impact Clips: Equal to 5 percent of quantity installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage

from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.2 ACOUSTICAL PANELS: (ACT-1, ACT-2)

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in “Interior Finish Key” in Drawings or comparable product by one of the following:

1. CertainTeed
2. Armstrong
3. Rockfon
4. USG

B. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide fire-resistance-rated panels as follows:

1. ACT-1 & ACT-2: Type and Form, Type IV Form 1: Mineral base with membrane-faced overlay.

D. Pattern:

1. ACT-1 & ACT-2: E (lightly textured).

E. Color: White.

F. Noise Reduction Coefficient (NRC):

1. ACT-1 & ACT-2: 0.8

G. Edge/Joint Detail: Trim Square Edge.

H. Thickness:

1. ACT-1 & ACT-2: 7/8 inch.

I. Modular Size:

1. ACT-1: 24 by 24 inches.
2. ACT-2: 24 by 48 inches.

J. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested in accordance with ASTM D3273, ASTM D3274, or ASTM G21 and evaluated in accordance with ASTM D3274 or ASTM G21.

2.3 METAL SUSPENSION SYSTEM:

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in Interior Finish Legend in Drawings or comparable product by one of the following:

1. CertainTeed
2. Armstrong
3. Rockfon
4. USG

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M and designated by type, structural classification, and finish indicated.

C. Wide-Face, Aluminum-Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, G60 coating designation; with prefinished, 15/16-inch- wide aluminum caps on flanges.

1. Fire Rating: Class A.
2. Structural Classification: Intermediate-duty system.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel or aluminum.
5. Cap Finish: Painted to match color of acoustical unit.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory

devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance with ASTM E1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B164, nickel-copper-alloy UNS No. N04400.
4. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

F. Hold-Down Clips: Manufacturer's standard hold-down.

G. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in Interior Finish Legend in Drawings or comparable product by one of the following:

1. CertainTeed
2. Armstrong
3. Rockfon
4. USG

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings to fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Install acoustical panel ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems in accordance with tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. 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.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:

    a. As indicated on reflected ceiling plans.

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 impact and clips in areas indicated; space in accordance with panel manufacturer's written instructions unless otherwise indicated.

    a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

7. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

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. Thermoplastic-rubber base.
2. Rubber molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. 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.

1.4 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. Furnish 5% of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.
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 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.

1.7 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 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

2.2 THERMOPLASTIC-RUBBER BASE: (RB-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide products as listed in the "Finish Schedule" in Drawings or comparable product by one of the following:

1. Roppe
2. Tarkett
3. Flexco
4. Mohawk Group

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:

    a. Style B, Cove.

C. Thickness: 0.25 inch.

D. Height: 4-3/8 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As Listed in "Interior Finish Key" in Drawings.

2.3 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

1. Concrete Substrates: Prepare according to flooring manufacture requirements.

a. PH and Moisture levels to meet each Manufacturer’s requirements.
b. Adhesion Testing: perform tests recommended by floor tile manufacturer.

2. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

B. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

C. 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 12 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 12 inches in length.

    a. 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. Tightly adhere to substrates throughout length of each piece.
2. 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 surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 6519 - RESILIENT TILE FLOORING: LUXURY VINYL TILE AND RUBBER TILE

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. Solid vinyl floor tile.
2. Rubber floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish Full-size tiles equal to 5 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 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.

1.9 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 floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F 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 floor tile, 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 SOLID VINYL FLOOR TILE: (LVT-1)

A. Basis of Design: As Listed in “Interior Finish Key” in Drawings.

1. Mannington Commercial Flooring
2. Shaw Contract
3. Bentley

B. Tile Standard: ASTM F 1700.

1. Class: Class I, Monolithic Vinyl Tile.

2. Type: B, Embossed Surface.

C. Thickness: As listed in the “Interior Finish Key” on the Drawings.

D. Size: As listed in the “Interior Finish Key” on the Drawings.

E. Seamless-Installation Method: As listed in the “Interior Finish Key” on the Drawings.

F. Colors and Patterns: As listed in the “Interior Finish Key” on the Drawings.

2.3 SOLID RUBBER FLOOR TILE: (RT-1)

A. Basis of Design: As Listed in “Interior Finish Key” in Drawings.

1. Zandur
2. Tarkett
3. Zoche

2.4 Tile Standard: ASTM F 1344, Class I-A, Homogeneous Rubber Tile, solid color.

A. Material: Made from EPDM and recycled SBR Rubber for increased slip resistance, shock resistance, force balance and comfort. Contains no virgin SBR.

B. Wearing Surface: Through body material.

C. Thickness: As listed in the “Interior Finish Key” on the Drawings.

D. Size: As listed in the “Interior Finish Key” on the Drawings.

E. Seamless-Installation Method: As listed in the “Interior Finish Key” on the Drawings.

F. Colors and Patterns: As listed in the “Interior Finish Key” on the Drawings.

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 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.

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 12 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 10 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 95 percent relative humidity level measurement.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

F. 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. tiles with grain running in one direction.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

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. Cover floor tile until Substantial Completion.

END OF SECTION 09 6519

096723 RESINOUS EPOXY FLOORING AND RESINOUS WALL SYSTEM

PART 1 - **GENERAL**

1.1 **SUMMARY**

A. Section includes the surface preparation and application requirements of high-performance resinous floor coating systems by a qualified applicator.

1. High-performance resinous flooring systems.
2. High-performance Integral wall base systems.
3. Metal Wall and Floor Transitions.

B. Coordination:

1. Coordinate surface preparation of substrates to avoid later difficulty or delay in performing the Work of this Section.
2. Review installation procedures under other Sections and coordinate the installation of items that must be installed prior to application of the resinous floor coating systems.
3. Substrate surface preparation and resinous floor coating application, including concrete resurfacing, to be completed by manufacturer's approved Applicator.
4. The Applicator shall coordinate with Architect/General Contractor regarding the availability of work areas, completion times, safety, access and other factors which could impact plant operations.

C. Related Sections:

1. Section 03 3000, Cast-in-Place Concrete

1.2 **REFERENCES**

A. This Section contains references to the governing standards and documents listed below. They are a part of this Section as specified and modified; the current version shall apply unless otherwise noted. In case of conflict between the requirements of this section and those of the listed documents, the more stringent of the requirements shall prevail.

B. American Concrete Institute (ACI):

1. ACI 301-10 – Specifications for Structural Concrete
2. ACI 308R – Guide to Curing Concrete

C. ASTM International (ASTM):

1. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
2. ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
3. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
4. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

D. International Concrete Repair Institute (ICRI):

1. Guideline No. 310.2 – Selecting and Specifying Concrete Surface Preparation for Sealer, Linings, and Polymer Overlays

E. NACE International (NACE):

1. NACE No. 6/SSPC-SP13 – Surface Preparation of Concrete

F. SSPC: The Society for Protective Coatings, (SSPC)

1. SSPC-SP13/NACE No. 6 Surface Preparation of Concrete

G. Unless otherwise specified, references to documents shall mean the documents in effect at the time of receipt of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents, the last version of the document before it was discontinued.

1.3 SUBMITTALS

A. Product Data Sheets: Copies of current technical data for each component specified and applied as outlined in this Section.

B. Safety Data Sheets: Copies of current Safety Data Sheets (SDS) for any materials brought on-site, including clean-up solvents, repair or resurfacing mortars and coating materials.

C. Installation Instructions: Manufacturer's written installation instructions for the materials specified in this Section.

D. Qualification Data: Submit proof of acceptability of the Applicator by manufacturer to Architect.

E. Construction Details: Copies of manufacturer's computer generated standard flooring details.

F. Jobsite Layout Plan: Including material storage/staging and equipment storage /staging.

G. Samples: For each resinous floor coating system submit a 3" x 6" sample of the system. Color, Texture and thickness shall be representative of the overall appearance as specified.

H. Jobsite Reports: Submit at the completion of Work

1. Daily Reports: Include surface preparation, substrate temperature, ambient air temperature, application procedures, materials applied, material quantities, material batch number, description of work completed and location thereof.
2. The Applicator shall maintain a copy of records until the expiration of the specified warranty period.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Applicator shall be qualified by the manufacturer prior to bid date.
2. Installation equipment shall be acceptable to the manufacturer.
3. Applicator shall establish quality control procedures and practices to monitor phases of surface preparation, storage, mixing, application, and inspection throughout the duration of the project.
4. Applicator shall provide a fulltime, on-site person whose dedicated responsibilities will include quality control of the application.

5. Applicator's quality control procedures and practices must include the following items:

    a. Training of personnel in the proper surface preparation requirements.
    b. Training of personnel in the proper storing, mixing, and application and quality control testing.

B. Pre-Installation Conference:

1. Before installing mock-ups General Contractor, Applicator, and Technical Representative of the Manufacturer shall meet on-site with Architect to discuss approved products and workmanship to ensure proper application of the products and substrate preparation requirements.
2. Review foreseeable methods and procedures related to the Work including but not necessarily limited to the following:

    a. Review Project Requirements and the Contract Documents.
    b. Review required submittals.
    c. Review status of substrate Work, including approval of surface preparations and similar considerations.
    d. Review requirements of on-site quality control inspection and testing.
    e. Review the requirements for preparing the quality control report as specified herein.
    f. Review availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
    g. Review material storage and staging.
    h. Review equipment storage and staging.
    i. Review waste management and disposal.
    j. Review environmental conditions, other project conditions, and procedures for coping with unfavorable conditions.
    k. Review regulations concerning code compliance, environmental protection, health, safety, fire and similar considerations.
    l. Review procedures required for the protection of the completed Work during the remainder of the construction period.

C. Single-Source Responsibility:

1. Materials shall be products of a single manufacturer or items standard with manufacturer of specified resinous floor coating materials.
2. Provide secondary materials which are produced or are specifically recommended by resinous floor coating system manufacturer to ensure compatibility of system.

D. Regulatory Requirements: Conform to applicable codes and ordinances for flame, fuel, smoke and volatile organic compounds (VOC) ratings requirements for finishes at time of application.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Deliver material in manufacturer's original, unopened and undamaged packages.
2. Clearly identify manufacturer's, brand name, contents, color, batch number, and any personal safety hazards associated with the use of or exposure to the materials on each package.
3. Packages showing indications of damage that may affect condition of contents are not acceptable.

B. Storage of Materials:

1. Materials shall be stored in accordance with manufacturer's recommendations in enclosed structures and shall be protected from weather and adverse temperature conditions.
2. Flammable materials shall be stored in accordance with state and local codes. Materials exceeding storage life as defined by the manufacturer shall be removed promptly from the site. Store materials only in area or areas designated by the Architect solely for this purpose.
3. Store in original packaging under protective cover and protect from damage.
4. Stack containers in accordance with manufacturer's recommendations.

C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

1.6 JOB CONDITIONS

A. Environmental Requirements:

1. Proceed with Work only when temperature and moisture conditions of substrates, air temperature, relative humidity, dew point and other conditions comply with the manufacturer's written recommendations and when no damaging environmental conditions are forecasted for the time when the material will be vulnerable to such environmental damage. Record such conditions and include in daily quality control report.
2. Maintain substrate temperature and ambient air temperature before, during and after installation above 55°F and rising in accordance with manufacturer's instructions.
3. Provide adequate ventilation during installation and full curing periods of the Work.
4. Coatings shall not be applied when ambient air temperature is within 5°F of the dew point and falling.

B. Dust and Contaminants: Protect work and adjacent areas from excessive dust and airborne contaminants during application and curing. Schedule Work to avoid excessive dust and airborne contaminants.

C. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent light conditions during resinous flooring application.

D. Close space to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

1.7 WARRANTY

A. Submit manufacturer's standard warranty for material.

B. Submit Applicator's standard warranty for workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design: Products of Tnemec Company, Inc., Kansas City, Missouri (816) 474-1616 www.tnemec.com are listed to establish a standard of performance and quality.

1. Other Approved Manufacturers:

a. Sherwin Williams High Performance Flooring
b. Desco

B. Materials specified are those that have been evaluated for the specific service. Request for material substitutions shall be in accordance with the requirements of the project specifications. Equivalent materials of other manufacturers may be submitted on written approval of the Architect. No request for substitution shall be considered that would decrease film thickness or offer a change in the generic type of coating specified. In no case will the request be considered unless information is received, in writing, ten (10) days prior to the bid opening date.

C. Requests for substitution shall include:

1. Manufacturer's literature for each product giving name, product number, generic type, descriptive information, laboratory testing showing results equal to the performance criteria of the products specified herein.
2. Side by side comparison of the performance attributes of the proposed materials as compared to the specified coating system.
3. List of ten (10) projects in which each product has been used and rendered satisfactory service.
4. The sum which will be added to or deducted from the base bid should alternate materials be accepted.

2.2 GENERAL

A. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

2.3 MATERIALS

A. Troweled Quartz Floors:

1. Coving: Tnemec Series 283 Coving Resin blended with aggregate
2. Tnemec Series 208 Epoxoprime MVT
3. Mortar: Tnemec Series 223 Deco-Trowel
4. First Grout: Tnemec Series 284 Deco-Clear
5. Grout: Tnemec Series 285 Satinglaze

    a. *NOTE: Additional grout coats may be required to achieve desired slip resistance.*

6. Finish: Tnemec Series 248 Everthane

B. Troweled Quartz Walls:

1. Joint at individual shower stalls where cement board and concrete curb meet: Series 215 with an embedded fiberglass mat Series 273 Part C 3" mat.
2. Primer: Tnemec Series 201 Epoxoprime
3. Mortar: Tnemec Series 285 Satinglaze blended with aggregate
4. Grout: Tnemec Series 285 Satinglaze
5. Finish: Tnemec Series 285 Satinglaze

2.4 GENERAL

A. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

2.5 ACCESSORY MATERIALS

A. Patching and Fill Material: Resinous product of or approved by manufacturer and recommended by manufacturer for application indicated.

B. Joint Sealant: Type recommended or produced by manufacturer for type of service and joint condition indicated.

1. Joint at individual shower stalls where cement board and concrete curb meet: Series 215 with an embedded fiberglass mat Series 273 Part C 3” mat.

PART 3 - **EXECUTION**

3.1 **GENERAL**

A. The Applicator shall cover or otherwise protect finish work or other surfaces not being coated within the scope of this Section. The Applicator shall erect and maintain protective tarps, enclosures and/or masking to contain debris, including dust or other airborne particles from surface preparation or application activities. This may include the use of dust or debris collection apparatus as required at no additional cost to Owner.

3.2 **EXAMINATION**

A. Site Verification of Conditions

1. The Applicator shall examine the areas and conditions under which the resinous floor coating Work is to be performed in accordance with NACE SP0892 and SSPC-SP13/NACE No. 6, and notify Architect in writing of conditions detrimental to the proper and timely completion of the Work.
2. All concrete should be cured using the procedures described in ACI 308, allowing a minimum of 28 days at 75F.
3. The Applicator shall confirm the presence of a vapor barrier to protect against the effects of moisture vapor transmission.
4. Commencement of the Work of this Section shall indicate that the substrate and other conditions of installation are acceptable to the Contractor and his Applicator, and will produce a finished product meeting the requirements of the Specifications. Defects resulting from accepted conditions shall be corrected by the Applicator at his own expense.

3.3 **SURFACE PREPARATION**

A. Concrete surfaces to receive resinous floor coatings shall be poured with a Smooth Troweled Finish in accordance with ACI 301.

B. All surfaces must be clean, dry and free of oil, grease and other contaminants, prior to preparation in accordance with NACE No. 6/SSPC-SP13. Concrete surfaces must be sound and capable of supporting the resinous floor coating system.

C. Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Shot-blast or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers, existing coatings, and other contaminants and to provide the recommended ICRI-CSP Profile.

D. Cracks, voids and other surface imperfections should be filled with the recommended filler or surfacer prior to the installation of the materials.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through the resinous floor coating system according to manufacturer's written recommendations.

3.4 APPLICATION

A. General: Apply components of resinous floor 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, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

    a. Apply joint sealant to comply with manufacturer’s written recommendations.

B. Apply products in accordance with Manufacturer’s written instruction as outlined in application guides and product data sheets.

C. Comply with manufacturer's written instructions for mixing and preparing materials and as applicable to substrates.

D. Terminations shall be installed in accordance with the StrataShield Standard Flooring Details Guide.

E. Areas not to receive resinous floor coating system shall be masked or otherwise protected to prevent these surfaces from being coated.

F. Surface Temperature: Prior to application, the surface temperature shall be per manufacturer’s written recommendations.

G. Material Temperature: Prior to application, the material temperature shall be per manufacturer’s written recommendations or between 65 degrees F and 85 degrees F. The material shall be stored at these temperatures at least 48 hours prior to use.

H. Apply resinous floor coatings according to manufacturer's written instructions. Use applicators and techniques suited for resinous floor coatings and substrate indicated.

I. Apply each material at not less than manufacturer's recommended spreading rate. Provide total cured material thickness indicated or as recommended in writing by manufacturer.

3.5 FIELD QUALITY CONTROL, INSPECTION AND TESTING

A. The Applicator shall perform the quality control procedures listed below in conjunction with the requirements of this Section.

B. Inspect materials upon receipt to ensure that they are supplied by the approved Manufacturer.

C. Surface Profile: Inspect and record substrate profile (anchor pattern). Surfaces shall be profiled equal to the required CSP amplitude as recommended by the resinous floor coating manufacturer in accordance with ICRI Guideline 310.2 and SSPC-SP13/NACE No. 6.

1. Compare and record the substrate profile once every 50 square feet with the Concrete Surface Profile (CSP) comparators in accordance with ICRI Guideline No. 310.2.

D. Surface Cleanliness: Prepared concrete surfaces shall be inspected for surface cleanliness after cleaning and drying, prior to resurfacing or coating application.

E. Concrete Moisture Testing: After surface preparation verify concrete dryness in accordance with ICRI Guideline 310.2 and SSPC-SP13/NACE No. 6 and the following test methods.

1. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

    a. Moisture vapor transmission not to exceed 15 pounds per 1,000 square feet in a 24 hour period.

2. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

    a. Relative humidity not to exceed 95 percent.

3. Consult manufacturer regarding questions and or recommendations in reference to moisture problems.

F. Measure and record ambient air temperature, relative humidity and dew point temperature once every two hours of each work shift.

G. Measure and record substrate temperature once every two hours using an infrared or other surface thermometer.

H. Dry-Film Thickness shall be determined using a surface area calculation for material consumption.

I. The Applicator is responsible for keeping the Architect informed of progress so that Architect may provide additional quality control at his/her discretion.

J. Inspection by the Architect or others does not absolve the applicator from his responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

K. Material Sampling: Owner may at any time and any number of times during the resinous flooring application require material samples for testing for compliance with requirements.

1. Contractor will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in the presence of Contractor, Architect and Construction Representative.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.6 MANUFACTURER’S FIELD SERVICES

A. Manufacturer’s technical representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.7 ACCEPTANCE CRITERIA

A. All surfaces shall be prepared, applied, and tested in accordance with the specification and referenced standards herein.

3.8 CLEANING AND PROTECTING

A. Protect the completed Work from traffic, physical abuse, liquids, and chemical exposure until the complete system has thoroughly cured for 24 hours.

B. At the completion of the Work, the Applicator shall remove materials and debris associated with the Work of this Section.

C. Clean surfaces not designated to receive resinous floor coating system. Restore areas in a manner acceptable to Architect.

D. Protect the completed Work from damage until Final Acceptance. Resinous floor coating systems damaged in any manner shall be repaired or replaced at the discretion of Architect, at no additional cost to Owner.

3.9 COATING SCHEDULE- TROWELED QUARTZ FLOOR

A. Surface Preparation: Prepare in accordance with SSPC-13/NACE 6 and ICRI Technical Guidelines. Abrasive Blast, shot-blast or mechanically abrade concrete surfaces to provide a minimum ICRI-CSP 3 or greater surface profile.

B. Coving: Tnemec Series 283 Coving Resin blended with Torginol's Dalmatian Quartz aggregate

1. Seal cove using Tnemec's Series 283 Coving Resin. Ensure no resin puddles at the floor to cove transition.
2. A smooth tape line transition to the wall system is desired. Talk with Tnemec representative for additional information.

C. Primer: Tnemec Series 208 Epoxoprime MVT applied at 80-100 sqft/gal

D. Mortar Coat: Tnemec Series 223 Deco-Trowel blended with Torginol's Dalmatian Quartz and applied at ¼"

E. Grout Coat: Tnemec Series 284 Deco-Clear applied at 80–100 square feet per gallon

F. Second Grout Coat: Series 285 Satinglaze applied at 150-200 square feet per gallon

1. The finished appearance and texture will depend on the film thickness and number of coats applied. Mock-ups should be applied to determine the desired finish appearance and texture.
2. Added slip resistance may be required depending on the location of the system.

G. Finish Coat: High-Solids Aliphatic Moisture Cured Urethane at 550-600 square feet per gallon

H. Total System Thickness: 1/4 inch

I. COATINGS SCHEDULE- TROWELED QUARTZ WALLS

J. Surface Preparation: Must be clean, dry and free of oil, grease and other contaminants.

1. Ensure moisture resistant joint compound has been used for sealing joints in substrate.
2. Joint at individual shower stalls where cement board and concrete curb meet: Series 215 with an embedded fiberglass mat Series 273 Part C 3" mat.

K. Primer: Tnemec Series 201 Epoxoprime applied at 200 sqft/gal

L. Mortar Coat: Tnemec Series 285 Satinglaze blended with Torginol's Dalmatian Quartz and applied at a nominal 3/16th-1/8th inch.

1. Ensure no resin puddles down the wall.
2. A smooth tape line transition from the wall to ceiling is desired. Talk with Tnemec representative for additional information.

M. Grout Coat: Tnemec Series 285 Satinglaze applied at 80–100 square feet per gallon

N. Second Grout Coat: Series 285 Satinglaze applied at 150-200 square feet per gallon

1. The finished appearance and texture will depend on the film thickness and number of coats applied. Mock-ups should be applied to determine the desired finish appearance and texture.

O. Metal Transition - Wall: (TR-1)

1. Metal trim, Schluter Schiene or Equal. Continuous trim as shown on the Interior Elevations on Drawings. Clean termination edge for Resinous Wall System.

END OF SECTION 09 6723

SECTION 09 9113 - EXTERIOR PAINTING

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. Primers.
2. Finish coatings.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
2. Section 08 1113 “Hollow Metal Doors and Frames” for shop priming doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples: For each type of topcoat product.

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.

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) Sherwin-Williams Company
2) Benjamin Moore and Co.
3) PPG Architectural Finishes Inc.

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, 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 topcoat manufacturer for use in paint system and on substrate indicated.

B. Colors: Match Architect's samples. Refer to Appendix B “Exterior Finish Key”

2.3 PRIMERS

A. Water-Based, Rust-Inhibitive Primer: Corrosion-resistant, water-based-emulsion primer formulated for resistance to flash rusting when applied to cleaned, exterior ferrous metals subject to mildly corrosive environments.

B. Water-Based, Galvanized-Metal Primer: Corrosion-resistant, pigmented, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.

2.4 FINISH COATINGS

A. Exterior, Water-Based, Light Industrial Coating, Semigloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.

1. Gloss Level: Manufacturer's standard semigloss finish.

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. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

C. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.

D. 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 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 specified in this Section.

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 areas where shop paint is abraded. 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 by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 INSTALLATION

A. Apply paints in accordance with manufacturer's written instructions.

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 the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint 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. Pipe hangers and supports.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

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.

3.5 EXTERIOR PAINTING SCHEDULE

A. EFIS Substrates (EPS-3A, EPS-3B):

1. Satin, Exterior Acrylic on EFIS:
   a. Contractor to Prep existing exterior surfaces per paint manufacturer’s requirements.
   b. Prime Coat: Contractor to verify if Prime Coat is needed. If Primecoat is needed, contractor to follow Manufacturer’s recommendation on product(s).
      1) Either Loxon Concrete & Masonry Primer/Sealer or Loxon Acrylic Block Surfacer.
   c. Topcoat: Sherwin Williams A100 Exterior Acrylic Latex, Satin, A82 Series

B. Ferrous Metal (Steel and Iron) Substrates (EPS-5A, EPS-5C, EPS-5D):

1. Semi-Gloss, Exterior Alkyd on Ferrous Metal:
   a. Prime Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
   b. Intermediate Coat: matching topcoat.
   c. Topcoat: S-W Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series

C. Non-Ferrous Metal (Galvanized) Substrates (EPS-5B):

1. Semi-Gloss, Exterior Alkyd on Non-Ferrous Metal:
   a. Prime Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
   b. Intermediate Coat: matching topcoat.
   c. Topcoat: S-W Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series

END OF SECTION 09 9113

SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

B. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete masonry units (CMUs).
2. Steel and iron.
3. Gypsum board.

C. Related Requirements:

1. Section 05 1200 "Structural Steel Framing for shop priming structural steel.

DEFINITIONS

D. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

F. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

G. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

H. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

I. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

J. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

ACTION SUBMITTALS

K. Product Data: For each type of product. Include preparation requirements and application instructions.

L. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches' square.
2. Step coats on Samples to show each coat required for system.

M. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

MAINTENANCE MATERIAL SUBMITTALS

N. 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.

O. Furnish quantity of 5 percent for each type, and color of paint.

DELIVERY, STORAGE, AND HANDLING

P. 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.

FIELD CONDITIONS

Q. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

R. 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

MANUFACTURERS

A. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated in Interior Painting Schedule or comparable product by one of the following:

1. Sherwin-Williams Company

2. Benjamin Moore and Co.

3. PPG Architectural Finishes Inc.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

PAINT, GENERAL

C. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

D. Material Compatibility:

1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

E. Colors: As listed in “Interior Finish Key” in Drawings.

PRIMER/SEALER

F. Primer Sealer, Latex, Interior: MPI #50.

METAL PRIMERS

G. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79.

H. Primer, Alkyd, Quick Dry, for Metal: MPI #76.

WATER-BASED PAINTS

I. Latex, Interior, High Performance Architectural, (Gloss Level 2): MPI #138.

J. Latex, Interior, High Performance Architectural, Semi-Gloss (Gloss Level 5): MPI #141.

SOLVENT-BASED PAINTS

K. Alkyd, Interior, Semi-Gloss (Gloss Level 5): MPI #47.

PART 3 - EXECUTION

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. Masonry (Clay and CMUs): 12 percent.
2. 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.

PREPARATION

F. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

G. 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.

H. 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.

I. 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.

J. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

K. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

APPLICATION

L. 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.

M. Desired Method for Application:
1. Prior to priming wall: wipe down wall, and clean dust from walls and working area.
2. Apply a coat of Primer.
3. As Sherwin Williams Primer is being spray applied, the primer is to be back rolled to assure even coverage.
4. Apply 2 topcoats of Sherwin Williams Intermediate/Topcoat paint for full coverage, as specified and approved in the submittal (spray or roll).
5. Use only sponge sander to correct imperfections in texture.

N. 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.

O. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

P. 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.

Q. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

    a. Equipment, including panelboards.

2. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Pipe hangers and supports.
    d. Metal conduit.
    e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    f. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

FIELD QUALITY CONTROL

R. 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.

CLEANING AND PROTECTION

S. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

T. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

U. 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.

V. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

INTERIOR PAINTING SCHEDULE:

W. Gypsum Board Substrates: (IPS-1A, IPS-1C, IPS-2A, IPS-2B, IPS-3A)

1. Eggshell Latex (IPS-1A, IPS-1C):
   a. Prime Coat: S-W ProMar 200 Zero VOC Latex Flat, B28W2600 Series.
   b. Intermediate Coat: matching topcoat.
   c. Topcoat: Pro Mar 200 HP Zero VOC Eggshell, B20-2600 Series.

2. Flat Latex (IPS-2A):
   a. Prime Coat: S-W ProMar 200 Zero VOC Latex Flat, B28W2600 Series.
   b. Intermediate Coat: matching topcoat.
   c. Topcoat: S-W ProMar 200 Zero VOC Latex Flat, B30-2600 Series.

3. Eggshell Epoxy (IPS-2B, IPS-3A)
   a. Prime Coat: S-W ProMar 200 Zero VOC Latex Flat, B28W2600 Series.
   b. Intermediate Coat: matching topcoat.
   c. Topcoat: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy Eggshell, K45 Series.

X. CMU Substrates: (IPS-1B, IPS-1D, IPS-1E, IPS-2C, IPS-3B)

1. Eggshell Latex (IPS-1B, IPS-1D, IPS-1E):
   a. Prime Coat: S-W Loxon® Block Surfacer, A24W200 Series.
   b. Intermediate Coat: matching topcoat.
   c. Topcoat: Pro Mar 200 HP Zero VOC Eggshell B20-2600 Series.

2. Flat Acrylic Dryfall on Haydite Soffit Block (IPS-2C):

   a. Prime Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
   b. Intermediate Coat: matching topcoat.
      Topcoat: S-W Pro Industrial™ Waterborne Acrylic Dryfall, Flat, Eg-Shel, Semi-Gloss, B42-80 Series.

3. Eggshell Epoxy (IPS-3B)
   a. Prime Coat: S-W Loxon® Block Surfacer, A24W200 Series.
   b. Intermediate Coat: matching topcoat.
   c. Topcoat: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy Eggshell, K45 Series.

Y. Steel Substrates: (IPS-2C, IPS-5A, IPS-5B)

1. Flat Acrylic Dryfall on Metal (IPS-2C):

   a. Prime Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
   b. Intermediate Coat: matching topcoat.
      Topcoat: S-W Pro Industrial™ Waterborne Acrylic Dryfall, Flat, Eg-Shel, Semi-Gloss, B42-80 Series.

2. Semi-gloss Enamel on Metal or Concrete (IPS-5A):

   a. Prime Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
   b. Intermediate Coat: matching topcoat.
   c. Topcoat: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy Semi-gloss, K46 Series.

3. Eggshell Enamel on Metal or Concrete (IPS-5B):

    a. Prime Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
    b. Intermediate Coat: matching topcoat.
    c. Topcoat: S-W Pro Industrial Pre-Catalyzed Water Based Epoxy Eggshell, B73-360 Series.

END OF SECTION 09 9123

SECTION 09 9723 - CONCRETE AND MASONRY COATINGS

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 surface preparation and the application of concrete and masonry coating systems on the following substrates:

1. Interior Substrates:

a. Concrete, horizontal surfaces.

B. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for curing methods for concrete surfaces to receive concrete and masonry coatings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

B. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

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. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. All materials used on the sealed concrete floor system shall be manufactured and provided by a single manufacturer to ensure compatibility and proper bonding.

B. Contractor shall have a minimum of 3 years experience installing concrete floor coatings similar to that which is required for this project and who is acceptable to the manufacturer.

C. Convene a pre-application meeting before the start of application of coating system. Require attendance of parties directly affecting work of this section, including: Architect, contractor,

applicator, and authorized representative of the coating system manufacturer and interfacing trades. Review the following:

1. Drawings and specifications affecting work of this section.
2. Protection of adjacent surfaces.
3. Surface preparation and substrate conditions.
4. Application.
5. Field quality control.
6. Cleaning.
7. Protection of coating system.
8. Coordination with other work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.

1. Protect concrete and masonry coating materials from freezing. Keep materials dry and storage area neat and orderly. Remove waste daily. Take necessary measures to ensure that workers and work areas are protected from health hazards resulting from handling, mixing, and applying the coating.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within the limits recommended by the manufacturer

B. Schedule coating work to avoid excessive dust and airborne contaminates. Protect work areas from excessive dust and airborne contaminates during coating application.

C. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.

D. Contractor shall test all concrete for moisture before applying a seamless coating. If moisture emissions exceed 5 lbs/1000 square feet (ASTM F1869) or if the relative humidity (RH) exceeds75% (ASTM F2170), contact the manufacturer before application.

E. Concrete must be at least 2500 psi.

F. Concrete must be cured for a minimum of 28 days before coating is applied.

G. Before any work is started, the applicator shall examine all surfaces for any deficiencies. Should any deficiencies exist, the architect, owner or general contractor shall be notified in writing and any corrections necessary shall be made.

H. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements: provide Sika Corporation, SCOFIELD SelectSeal Plus, water-based, urethane fortified acrylic sealer or comparable product by one of the following:

1. BASF Corporation; Construction Systems.
2. Euclid Chemical Company (The); an RPM company.
3. H&C Decorative Concrete Products

B. Source Limitations: Obtain concrete and masonry coating materials from single source from single manufacturer.

2.2 CONCRETE AND MASONRY COATINGS, GENERAL

A. Material Compatibility:

1. Materials for use within each coating system shall be compatible with substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. Products shall be recommended in writing by concrete and masonry coating manufacturers for use on substrate indicated.

B. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings 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."

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. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating 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 sealing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Prepare surfaces using methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

E. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

1. Create an appropriate surface profile by one of the following to achieve a clean, uniform surface:

a. Mechanically diamond grind the surface with 60 - 80 grit tools.
b. Abrasive blast clean surfaces to comply with SSPC-CAB 3 "Brush Blast Cleaning."

2. Sweep and vacuum surfaces entirely prior to installation.
3. Rout and clean moving cracks and joints: patch with manufacturer’s recommended concrete patch material.
4. Repair any non-moving surface deviations with manufacturer’s recommended patching material.

3.3 APPLICATION

A. Apply concrete and masonry coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Uniformly apply coatings at spread rates and in number of coats to achieve specified coverage rates recommended by the manufacturer.

B. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.5 MAINTENANCE

A. Contractor shall provide to owner, maintenance and cleaning instructions for the floor system upon completion of work. Owner is required to clean and maintain the surfaces to maintain manufacture's warranty.

3.6 INTERIOR CONCRETE AND MASONRY COATING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Clear Water-Based Low-Odor Acrylic Sealer System, Semi-Gloss:

a. First Coat: Sealer, clear water-based, matching topcoat.
b. Topcoat: Sealer, clear water-based, gloss.

1) SCOFIELD® SelectSeal™ Plus, a brand of Sika Corporation, Water-Based, Urethane fortified Acrylic Concrete Sealer.

END OF SECTION 09 9723

SECTION 10 2113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments.

B. Related Requirements:

1. Section 09 2216 "Non-Structural Metal Framing" for blocking.
2. Section 10 2800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

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.

C. Samples for Verification: Actual sample of finished products for each type of toilet compartment, hardware, and accessory.

1. Size: Manufacturer's standard size.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For toilet compartments.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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: 10 fasteners of each size and type.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain plastic toilet compartments from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" ICC A117.1 for toilet compartments designated as accessible.

2.3 SOLID-PLASTIC TOILET COMPARTMENTS: (HDPE-1)

A. Basis of design: Subject to compliance with requirements, provide Scranton Products, Hiny Hider or comparable product by one of the following:

1. Accurate Partitions
2. ASI Global Partitions
3. Global Partitions.
4. Bradley Partitions.

B. Toilet-Enclosure Style: Overhead braced Floor anchored, privacy type.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color throughout thickness of material. Provide with no-sightline system consisting of door and pilaster lapped edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).

1. Integral Hinges: Configure doors and pilasters to receive integral continuous hinges, aluminum stainless steel.
2. Heat-Sink Strip: Manufacturer's continuous, extruded-aluminum or stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
3. Color: One color and pattern in each room as listed in “Interior Finish Key” in Drawings.

E. Urinal-Screen Construction: Matching panel construction.

F. Pilaster Sleeves (Caps): Manufacturer's standard design; solid plastic or stainless steel.

1. Plastic Color: Matching pilaster.

G. Overhead Cross Bracing for Ceiling-Hung Units: As recommended by manufacturer and fabricated from solid plastic.

2.4 HARDWARE AND ACCESSORIES

A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories. Mount with through bolts.

1. Hinges:

a. Manufacturer's continuous, cam type that swings to a closed or partially open position , allowing emergency access by lifting door.

1) Material, Continuous Hinge: Aluminum Stainless steel.

b. Manufacturer's standard hinge.

2. Latch and Keeper: Manufacturer's surface-mounted latch unit, designed for emergency access, and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.

a. Material: Stainless steel.

3. Coat Hook: Manufacturer's combination hook and rubber-tipped bumper, sized to prevent inswinging door from hitting compartment-mounted accessories.

a. Material: Stainless steel.

4. Door Bumper: Manufacturer's rubber-tipped bumper at outswinging doors.

a. Material: Stainless steel.

5. Door Pull: Manufacturer's unit at outswinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at toilet enclosures designated as accessible.

a. Material: Stainless steel.

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 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.

2.5 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

2.6 FABRICATION

A. 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: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Manufacturer's standard corrosion-resistant anchoring assemblies at pilasters and walls, with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Urinal-Screen Posts: Manufacturer's standard corrosion-resistant anchoring assemblies at posts and walls, with leveling adjustment nuts at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

E. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, inswinging doors for standard toilet enclosures and 36-inch- wide, outswinging doors with a minimum 32-inch- wide, clear opening for toilet enclosures 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 or Screens: 1/2 inch.

b. Panels or Screens and Walls: 1 inch.

2. Full-Height (Continuous) Brackets: Secure panels or screens 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.

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.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 10 2113.19

SECTION 10 2239 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Operable acoustical panel partitions.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
2. Section 09 2900 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.

1.2 DEFINITIONS

A. NIC: Noise Isolation Class.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Class.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data:

1. Operable acoustical panel partitions.

B. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, attachment details , and numbered panel installation sequence.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Textile Facing Material: Full width by not less than 36-inch- long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
2. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
3. Panel Edge Material: Not less than 3 inches long.
4. Chair Rail: Manufacturer's standard-size unit, 6 inches long.
5. Hardware: One of each exposed door-operating device.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Partition track, track supports and bracing, switches, turning space, and storage layout.
2. Suspended ceiling components.
3. Structural members to which suspension systems will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. HVAC ductwork, outlets, and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Smoke detectors.
    f. Access panels.

6. Plenum acoustical barriers.

B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

C. Qualification Data: For Installer.

D. Product Certificates: For each type of operable panel partition.

E. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. Include the following:

    a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
    b. Seals, hardware, track, track switches, carriers, and other operating components.

1.7 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. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties in accordance with test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance in accordance with ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.

2.2 OPERABLE ACOUSTICAL PANEL PARTITIONS

A. Operable Acoustical Panel Partitions: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Manufacturers: Subject to compliance with requirements, provide Hufcor Inc. "U900 Unispan Suspension System" with Hufcor Inc. Series 642 Paired Operable Paritions, or products equal by one of the following

a. KWIK-WALL Company.
b. Modernfold, Inc.

B. Panel Operation: Manually operated, continuously hinged panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: Equal widths.

E. STC: Not less than 52.

F. NRC: Not less than 0.65.

G. Panel Weight: 10 lb/sq. ft. maximum.

H. Panel Thickness: Nominal dimension of 4 inches.

I. Panel Materials:

1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.
3. Gypsum Board: ASTM C1396/C1396M.
4. Medium-Density Fiberboard: ANSI A208.2.

J. Panel Closure: Manufacturer's standard unless otherwise indicated.

K. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

1. Hinges: Manufacturer's standard.

L. Finish Facing: Manufacturers standard vinyl-coated fabric.

2.3 SEALS

A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.
2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Horizontal Top Seals: Continuous-contact, resilient seal exerting uniform constant pressure on track or resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.

C. Horizontal Bottom Seals:

1. Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

a. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 2 inches between retracted seal and floor finish.

2.4 PANEL FINISH FACINGS

A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with invisible seams complying with Shop Drawings for location, and with no gaps or overlaps. Horizontal butted edges seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
2. Where facings with directional, repeating, or matching grain are indicated, mark facing top and attach facing in same direction.
3. Match facing pattern 72 inches above finished floor.

B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with WA-101, Type III-Heavy Duty; Class A.

1. Total Weight: 30 oz./LY
2. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
3. Color/Pattern: As selected by Architect from manufacturer's full range.

C. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:

1. Steel, Painted: Finished with manufacturer's color as selected by Architect from manufacturer's full range.
2. Aluminum: Finished with manufacturer's standard color anodic finish.

2.5 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum mounted directly to overhead structural support, with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish .

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

1. Multidirectional Carriers: Capable of negotiating intersections without track switches.

C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

2.6 ACCESSORIES

A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.

1. Manufacturer's standard method to secure storage pocket door in closed position.
2. Rim Lock, Key Operated: Key-operated lock cylinder, keyed to master key system, to secure storage pocket door in closed position. Include two keys per lock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, floor levelness, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF OPERABLE PANEL PARTITIONS

A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

B. Install panels in numbered sequence indicated on Shop Drawings.

C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

E. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Verify that safety devices are properly functioning.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 10 2239

SECTION 10 2600 - WALL AND DOOR PROTECTION

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. Corner guards.
2. Abuse-resistant wall coverings.
3. Rub Rails.

B. Related Requirements:

1. Section 08 7100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

C. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.
2. Abuse-Resistant Wall Covering and Rub Rails: 6 by 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 5 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch- long units and two, 96-inch- long units.
2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

    a. Store corner-guard covers in a vertical position.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
    b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; 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.

2.3 CORNER GUARDS: (CG-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide products as listed in the “Finish Schedule” in Drawings or comparable product by one of the following:

1. InPro
2. C/S – Construction Specialties
3. Koroseal

B. Surface-Mounted, Plastic-Cover Corner Guards, Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

1. Cover: Extruded rigid plastic, minimum 0.08-inch (2mm) wall thickness; in dimensions and profiles indicated on Drawings.

    a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
    b. Height: 4 feet. As Listed in the “Interior Finish Key” in Drawings.
    c. Color and Texture: As Listed in the “Interior Finish Key” in Drawings

2. Continuous Retainer: Minimum 0.070-inch- thick, one-piece, extruded aluminum.
3. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required; thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D 256, Test Method A.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

D. Adhesive: As recommended by protection product manufacturer.

2.5 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings. If not indicated on Drawings, install at heights indicated below:

1. Cornerguards: Bottom of cornerguard and retainer directly above wall base.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.

3. Adjust end and top caps as required to ensure tight seams.

D. Abuse-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

E. Door-Frame Protectors: Install on both door jams.

F. Fire Doors: Install protection according to the listing of each item.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 2600

SECTION 10 2613 - FRP PANELS

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. FRP Panels and trim.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.

1. Include similar Samples of accent strips and accessories involving color selection.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated.

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. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; sheet material, thickness as indicated.

1. Chemical and Stain Resistance: Tested according to ASTM D 543
2. Self-extinguishing when tested according to ASTM D 635.
3. Flame-Spread Index: 25 or less.
4. Smoke-Developed Index: 450 or less.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 FRP PANELS

A. FRP Panels: Fabricated from plastic sheet material.
1. Basis-of-Design Product: Subject to compliance with requirements, provide products as listed in the “Finish Schedule” in Drawings or comparable product by one of the following:
   a. Panolam
   b. InPro
   c. C/S – Construction Specialties

2. Basis-of-Design Product: Subject to compliance with requirements, provide Panolam, .090” thick, Textured Wall Panels or comparable product by another manufacturer.
3. Sheet Thickness: 0.090 inch minimum.
4. Color and Texture: Refer to “Interior Finish Key” on Drawings.
5. Height: Full wall.
6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
7. Mounting: Adhesive.

2.3 FABRICATION

A. Fabricate FRP wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating**,** and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

    a. Provide anchoring devices to withstand imposed loads.
    b. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
    c. Adjust end and top caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 2613

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

B. Related Requirements:

1. Section 08 8300 "Mirrors" for frameless mirrors.
2. Section 09 6723 "Resinous Epoxy Flooring and Resinous Wall System" for shower wall coatings.

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:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Custodial accessories.

B. Product Data Submittals: For each 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.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

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 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials:

1. Paper Towel Dispenser Surface Mounted (PTD)
2. Single Automatic Soap Dispenser (SD)

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 360 lbf concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser (TPD):

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

   a. ASI-American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Double-roll dispenser.
3. Mounting: Partition mounted, serving two adjacent toilet compartments and Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Grab Bar (GB) for ADA Toilet Stalls:

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

a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. OD: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings .

C. Sanitary-Napkin Disposal Unit (SND):

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

a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Mounting: Partition mounted, dual access and Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

D. Mirror Unit (Mirror):

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

a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Frame: Stainless steel angle, 0.05 inch thick.

a. Corners: Welded and ground smooth.

3. Size: As indicated on Drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screw or bolts.

2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Grab Bar (GB) for Shower Stalls:

1. Basis of Design: Bobrick B68616 L-Shaped Horizontal Shower Compartment Bar 24x36
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

3. Mounting: Flanges with concealed fasteners.
4. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

5. OD: 1-1/2 inches.
6. Configuration and Length: single L-shaped unit, 24x36 and as indicated on Drawings

B. Shower Curtain Rod (SCR):

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

    a. ASI-American Specialties, Inc.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.

2. Description: 1-1/2-inch- OD, straight rod.
3. Configuration: As indicated on Drawings
4. Mounting Flanges: Concealed fasteners; in material and finish matching rod.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin)

C. Folding Shower Seat (FSS):

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

    a. ASI-American Specialties, Inc.
    b. Bobrick Washroom Equipment, Inc.
    c. Bradley Corporation.
    d. Inprocorp.

2. Configuration: L-shaped seat, designed for wheelchair access Rectangular seat.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin)
5. Dimensions: 14.375" x 27.5"

D. Corner Shower Shelf (CSS):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. InPro Corp. (Basis of Design)
    b. Swan
    c. Tenedos

2. Configuration: Corner of shower, Refer to drawings.

3. Model: Large InPro, Diamond Corner Soap Dish
4. Material Type: Prism™ Solid Surface
    a. Color to be selected from manufacturers full range.
5. Mounting Mechanism: Silicone Adhesive, Silicone sealant on all edges.
6. Dimensions: 7.25"H x 10.25"W

E. Robe Hook (RH):

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

   a. ASI-American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Double -prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

2.5 CUSTODIAL ACCESSORIES

A. Custodial Mop and Broom Holder (MBH):

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

   a. ASI-American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches.
4. Hooks: Four
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

   a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
   b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.6 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.7 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 in accordance with 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.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 2800

SECTION 10 4413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 10 4416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets
2. Section 21 1200 "Fire-Suppression Standpipes" for fire-hose connections.

1.2 PREINSTALLATION CONFERENCE

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. 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.
2. Show location of knockouts for hose valves.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

1.4 CLOSEOUT SUBMITTALS

1.5 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 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

2.3 FIRE-PROTECTION CABINET (FEC)

A. Cabinet Type: Suitable for fire extinguisher .

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

    a. Babcock-Davis.
    b. Guardian Fire Equipment, Inc.
    c. JL Industries; Activar Construction Products Group, Inc.
    d. Larsen's Manufacturing Company.
    e. Nystrom, Inc.

B. Cabinet Construction: Nonrated .

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. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Steel sheet Same material and finish as door.

F. Door Material: Steel sheet .

G. Door Style: Fully glazed panel with frame .

H. Door Glazing: Tempered float glass (clear) .

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 .
2. Provide continuous hinge, of same material and finish as trim, , permitting door to open 180 degrees.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect .

    a. Identify fire extinguisher in fire-protection cabinet with the words " FIRE EXTINGUISHER ."

1) Location: Applied to cabinet glazing .
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red .
4) Orientation: Vertical .

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

   a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
   b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   c. Color: As selected by Architect from manufacturer's full range .

2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear) .

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Prepare doors and frames to receive locks.
5. 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. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

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. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification:

1. Apply vinyl lettering at locations indicated.
2. Apply decals vinyl lettering on field-painted fire-protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 4413

SECTION 10 5300 – PREFABRICATED CANTILEVER CANOPY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work in this section includes furnishing and installation of extruded aluminum overhead cantilever supported canopies.
B. Related Items and Considerations
    1. Flashing of various designs may be required. Generic flashing supplied by canopy supplier. Specialty flashing to be supplied by installer.
    2. Determine wall construction, make-up and thickness.
    3. Ensure adequate wall condition to carry canopy loads where required.
    4. Consider water drainage away from canopy where necessary.
    5. Any necessary removal or relocation of existing structures, obstructions or materials.

1.2 Quality Assurance

A. Products meeting these specifications established standard of quality required as manufactured.

1.3 Field Measurement

A. Confirm dimensions prior to preparation of shop drawings when possible.
B. If requested, supply manufacturer s standard literature and specifications for canopies.
C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.4 Performance Requirements

A. Canopy must conform to local building codes.
B. PE Stamped calculations are required.

1.5 Deliver, Storage, Handling

A. Deliver and store all canopy components in protected areas.

PART 2 – PRODUCTS

2.1 Manufacturer

A. Basis of Design: Mapes Canopies, Super Lumideck with hander rod support
    1. Pre-engineered modular design with internal drainage

B. Approved Manufacturers:
    1. Mapes Canopies, Lincoln, Nebraska, Phone: 1-888-273-1132, Fax: 1-877-455-6572.
    2. Lawrence Fabric & Metal Structures, St. Louis, Missouri, Phone: 1-800-527-3840
    3. MASA Architectural Canopies 1-866-538-7610

2.2 Materials

A. All-extruded aluminum (T6-6063)
B. Fascia: 0.125” x 8” J profile
C. Decking: 0.078” thick x 2-3/4” corrugated
D. Cantilever supported brackets shall be standard finish.

2.3 Finishes

A. Finish type: Standard Bronze Baked Enamel

2.4 Fabrication

A. Extruded aluminum canopy shipped with the materials precut to size for field assembly.
B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
C. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Rear Gutter at corner- Leader By Others.

PART 3 - EXECUTION

3.1 Inspection

A. Confirm that surrounding area is ready for the canopy installation.
B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by manufacturer.
C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

3.2 Installation

A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

3.3 After installation

A. Entire system shall be left in a clean condition.

END OF SECTION 10 5300

SECTION 11 4000 – 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 and shall be from and certified NSF fabricator and bear the NSF Seal

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 ear 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 e 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.

3. 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 turned down 1-1/2” with ½” toe in, except where adjacent to walls or high adjoining equipment, where top is turned up 6” and back 1” on a 90 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” toe in edge. Shelves for both cabinet bases and pipe base tables are to be rigidly braced.

2. All stainless steel under shelves on open pipe leg tables shall be coved up 2” on the rear when the tables are up against a wall

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 itemized specifications. 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. Drain boards under 3'0" long to be supported by stainless steel angles welded from end of drain board to sink facing, just above cove of compartment bottom. Drain boards over 3'0" long to be supported on pipe stands, as previously specified. Unless otherwise noted, these drain boards 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 18-gauge stainless steel. All exposed edges turned down 1-1/2" with 1/2" toe in. 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, stored by General Contractor and installed in new locations, where shown on plans. Related trades are to see that all service lines are disconnected prior to General Contractor moving and storing the equipment.

2. Present equipment shall be cleaned, serviced, and stored by Owner and/or General contractor prior to Foodservice Equipment Sub-Contractor. re-installing into locations as shown on plan

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 and/or adjacent equipment

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. All exterior refrigerant piping and fittings shall have insulation jacketing. UV resistant Ventureclad 1577CW or Equal

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. Alter 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, CAN RACK: ONE (1) REQUIRED

Manufacturer: New Age, Channel, Lakeside

Model: 1225

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 2, REFRIGERATOR: ONE (1) REQUIRED

Manufacturer: True, Continental, Traulsen

Model: T-49-HC
Half height doors hinged as shown on plan.
Six (6) extra shelves
Three (3) year parts and labor warranty
Seven (7) year warranty on compressor
Cord and plug
Caters

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 3, FREEZER: ONE (1) REQUIRED

Manufacturer: True, Continental, Traulsen

Model: T-49F-HC
Three door unit w/ full height doors
Nine (9) additional shelves
Three (3) year parts and labor warranty
Seven (7) year warranty on compressor
Cord and plug
Caters

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 4, STORAGE SHELVING: ONE (1) LOT REQUIRED

Manufacturer: Metro, Eagle, Cambro

Style: Super Erecta
Twelve (12) 2448NC shelves
Twelve (12) 74P post

To be assembled as individual sections, four (4) shelves high.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 5, RACK: ONE (1) REQUIRED

Manufacturer: New Age, Piper, Channel

Model: 4330
Pan stops

Wrap around bumper

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 6, MIXER: ONE (1) REQUIRED

Manufacturer: Globe, Hobart, Univex

Model: SP20
Cord and plug
Standard equipment
Stainless steel bowl
9" vegetable slicer
Grater plate
5/16" shredder plate
3/16" shredder plate
#12 plate holder

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 7, PORTABLE MIXER STAND: ONE (1) REQUIRED

Manufacturer: Advance Tabco, John Boos, Piper

Model: MX-SS-302
Casters

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 8, HAND SINKS: TWO (2) REQUIRED

Manufacturer: Advance Tabco, Eagle, John Boos

Model: 7-PS-70
Punch with 8"O.C. Faucet holes
Fisher splash mounted faucet consisting of 54437, 61549, and 75626 components
Splash shields
Crumb cup drain
Mounted at ADA height to 34” above finished floor

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 9, POT AND PAN RACKS: ONE (1) REQUIRED

Manufacturer: Metro, Eagle, Cambro

Style: Super Erecta
Four (4) 2460NK3 shelves
Four (4) 74UPK3 post
Four (4) Casters

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 10, THREE COMPARTMENT SINK: ONE (1) REQUIRED N.I.C.

The Three Compartment Sink is existing equipment and shall be re-used.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 11, WALL SHELVES: TWO (2) REQUIRED

Manufacturer: Advance Tabco, Eagle, John Boos

Model: WS-12-120
Stainless steel cantilever brackets

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 12, CLEAN DISH TABLE: ONE (1) REQUIRED

Size: Approximately 5’-0” x 2’-6” x 3’-1” high over roll rim

Description: 14 gauge stainless steel construction
1-1/2” roll rim 3” high on front
15-1/2” high splash on rear and right end
1-5/8” o.d. stainless steel tubing legs with stainless steel gussets and stainless steel adjustable feet
18 gauge stainless steel under shelf welded to legs 10" above finished floor where possible

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 13, WALL SHELVES: TWO (2) REQUIRED

Manufacturer: Advance Tabco, Eagle, John Boos

Model: WS-15-48
Stainless steel cantilever brackets

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 14, DISH MACHINE: ONE (1) REQUIRED

Manufacturer: CMA, Hobart, Champion

Model: C
Corner Installation
Low temp Chemical Sanitizing machine

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 15, SOILED DISH TABLE: ONE (1) REQUIRED

Size: Approximately 9’-0” x 2’-6” x 3’-1” high over roll rim

Description: 14 gauge stainless steel construction
1-1/2" dia. roll rim on front and left end
15 1/2" high splash on rear. KEC shall coordinate splash with roll down door
One (1) 21" x 21" x 6"d. scrap sink w/removable rack slide and removable, perforated scrap basket
6" high deck at sink

One (1) Fisher deck mounted pre-rinse spray at scrap sink, consisting of 13080, 2932-0002, and 2928 components
One (1) Fisher #22209 twist lever drain
Where shown the top shall extend through wall opening at 2'-10" AFF
Top extension shall be ¾" higher than bed of table
2" turn up at walls
Top shall extend approximately 1" past wall with 6" straight turn down than back to wall (enclose splash on ends)
St. St. picture frame trim around opening
1-5/8" o.d. stainless steel tubing legs with stainless steel gussets and stainless steel adjustable feet
1-5/8" o.d. stainless steel cross rails. Open across front where shown for dish racks

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 16, RACK SHELF: ONE (1) REQUIRED

Size: Approximately 4'-6" long, single sided

Description: 14 gauge stainless steel construction
Single sided slanted
Inverted raised rolled rim along front
2" straight turn up on rear and ends
Stainless steel wall brackets that will hold shelf off wall far enough to miss roll down door

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 17, TRASH CAN: ONE (1) REQUIRED N.I.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSATLLED THROUGH THE SUPPLY CHANNELS

ITEM 18, ICE MACHINE: ONE (1) REQUIRED N.I.C.

The Ice Machine is existing equipment and shall be re-used.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 19, WORK TABLE: ONE (1) REQUIRED

Manufacturer: Advance Tabco, Eagle, John Boos

Model: FMS-305

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 20, DROP-IN DUMP SINK: ONE (1) REQUIRED

Manufacturer: Advance Tabco, Eagle, John Boos

Model: DI-1-1515
Fisher deck mounted 4" O.C. pantry faucet to consist of 53880 and 75626 components
Crumb cup drain

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 21, COFFEE MAKER: ONE (1) REQUIRED N.I.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 22, TEA BREWER: ONE (1) REQUIRED N.I.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 23, REFRIGERATOR: ONE (1) REQUIRED N.I.C.

The Refrigerator is existing equipment and shall be re-used.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 24, HOOD W/FIRE PROTECTION SYSTEM: ONE (1) REQUIRED N.I.C.

The Hood w/Fire Protection System shall be furnished and installed by the H.V.A.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 25, DUCT AND FAN: ONE (1) REQUIRED N.I.C.

The Duct and Fan shall be furnished and installed by the H.V.A.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSATLLED AS PART OF THE BASE BID

ITEM 26, ST. ST. WALL PANELING: ONE (1) REQUIRED N.I.C.

The St. St. Wall Paneling shall be furnished and installed by the H.V.A.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 27, COMBI OVEN: ONE (1) REQUIRED

Manufacturer: Alto-Shaam, Rational, Convotherm

Model: CTP7-20G
Natural gas
(1) CE-24750 Combitherm Cleaning liquid, (12) 1 quart containers per case
(1) CE-28892 Combi Clean Cleaning Tabs, (90) packets each container
Everpure #EV979722 water filtration system
Mechanical startup check
Stand with st. st. legs with flanged feet, shelf, and pan slides

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 28, TILT SKILLET: ONE (1) REQUIRED

Manufacturer: Vulcan, Southbend, Groen

Model: VG30
Natural gas
2" tangent draw-off
Single pantry faucet
Faucet bracket
Lip strainer

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 29, TRENCH DRAIN: ONE (1) REQUIRED

Size: Approximately 3’-6" x 2’-0"

Description: 14 gauge stainless steel construction
Fully welded, Anti-Splash design.
Flashing flange
Dome strainer
One (1) 4” drain connections
Stainless steel removable grates with st. st. filler plates as required where equipment legs may land on grate

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 30, RANGE: ONE (1) REQUIRED

Manufacturer: Vulcan, Southbend, Garland

Model: 36C-6BN
Natural gas
Casters
Convection oven base
Single high shelf
Rear gas connection
Natural Gas
Dormont Super-swivel quick disconnect complete with restraining device

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 31, WORK TABLE: ONE (1) REQUIRED N.I.C.

The Work Table is existing equipment and shall be re-used.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 32, HANGING UTENSIL RACK: ONE (1) REQUIRED

Size: Approximately 5’-0” x 2’-0”

Description: 3/16” x 2” stainless steel band construction w/radius ends
One (1) lower band 12” below upper band
Stainless steel double side pot hooks 8” o.c.
Stainless steel rods supported to ceiling (structure)
Mount unit at 7’-6” above finished floor to upper band

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 33, HOT HOLDING CABINET: ONE (1) REQUIRED

Manufacturer: Vulcan, Metro, FWE

Model: VBP15
Split cavity
Pass thru style
Cord and plug
Magnetic edge mount door handle
Perimeter bumper
Casters

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 34, MICROWAVE: ONE (1) REQUIRED N.I.C.

The Microwave is existing equipment and shall be re-used.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 35, COUNTER W/ PREP SINK: ONE (1) REQUIRED

Size: Size and shape as shown on plans x 3'-0" high

Description: 14 gauge stainless steel top and splash
1-1/2” straight turn down on front, right and left ends
6” high x 1” deep splash on rear
At prep table portion provide the following:
One (1) 18" x 20" x 10" deep sink compartment with 6" x 6" high deck at sink
One (1) Fisher deck mounted faucet consisting of 57765 and 41726 components
One (1) Fisher #22209 twist lever drain
One (1) 20” x 20” x 5”d. stainless steel drawer assemblies complete w/stainless steel housing, nylon rollers, stainless steel removable drawer pans, and double pan drawer face with full length integral recessed pulls
18 gauge stainless steel under shelf welded to legs, 10" above finished floor
1-5/8" o.d. stainless steel tubing legs with stainless steel gussets and stainless steel adjustable feet
At serving counter portion provide the following:
Top cut to accept Drop-in Units.
One (1)Fisher fill faucet at hot wells to consist of 41726 and 58009 components
18 gauge stainless steel cabinet base construction
18 gauge stainless steel bottom and intermediate shelves where possible
Where shown at the window opening the top shall turn down 2” over a stainless steel tray slide. Tray slide shall cap low wall at 2’-10” AFF, extend thru the openings and shall extend approximately 1” beyond wall face. Top shall have a 2” straight turn down on front (customer side) then return to the wall. Ends to be closed
6” high stainless steel legs with stainless steel adjustable feet

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 36, WALL SHELF: ONE (1) REQUIRED

Manufacturer: Advance Tabco, Eagle, John Boos

Model: WS-12-120
Stainless steel cantilever brackets

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF ALTERNATE 1

ITEM 37, SLICER: ONE (1) REQUIRED

Manufacturer: Globe, Hobart, Univex

Model: G14
Food fence

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 38, DROP-IN HOT FOOD UNIT: ONE (1) REQUIRED

Manufacturer: Vollrath, Hatco, Atlas Metal

Model: 3640701
1000 wat elements
Cord and plug
Rear drain valve extension

Voltage: 208-60-1

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 39, DROP-IN COLD PAN: ONE (1) REQUIRED

Manufacturer: Vollrath, Hatco, Atlas Metal

Model: FC-4C-03120-N
Cord and plug
Perforated false bottom
Rear drain valve extension

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 40, PROTECTOR GUARD UNIT: ONE (1) REQUIRED

Manufacturer: Premier, BSI, Atlas Metal

Model: TM2R-A
23” high post x lengths as shown on plan
Post closet to tray slide only, to be anchored approximately 12” down into cabinet base for additional support
⅜” tempered glass with radiused corners – front panels
⅜” tempered glass with radiused corners – top shelf
Brushed aluminum finish
Concealed fasteners

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 41, MOP SINK: ONE (1) REQUIRED N.I.C.

The Mop Sink shall be furnished and installed by the General Contractor.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 42, MOP RACK: ONE (1) LOT REQUIRED N.I.C.

The Mop Rack shall be furnished and installed by the General Contractor.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED AS PART OF THE BASE BID

ITEM 43, SPARE NUMBER

ITEM 44, TRAY AND SILVER CART: ONE (1) REQUIRED

Size: Piper, Lakeside, Cambro

Description: 715-1-8
Rotating bumpers
Nylon silver ware cylinders

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 45, BEVERAGE TABLE: ONE (1) REQUIRED N.I.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS
.

ITEM 46, AIR POTS: ONE (1) LOT REQUIRED N.I.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS

ITEM 47, TEA DISPENSERS: ONE (1) LOT REQUIRED N.I.C.

NOTE: THIS ITEM SHALL BE FURNISHED AND INSTALLED THROUGH THE SUPPLY CHANNELS
.

ITEM NUMBER	ITEM DESCRIPTION	ITEM PRICE
1.	CAN RACK	SUPPLY CHANNELS $_____
2.	REFRIGERATOR	SUPPLY CHANNELS $_____
3.	FREEZER	SUPPLY CHANNELS $_____
4.	STORAGE SHELVING	SUPPLY CHANNELS $_____
5.	RACK	SUPPLY CHANNELS $_____
6.	MIXER	SUPPLY CHANNELS $_____
7.	MIXER STAND	SUPPLY CHANNELS $_____
8.	HAND SINKS (2)	BASE BID $_____
9.	POT AND PAN RACK	SUPPLY CHANNELS $_____
10.	THREE COMPARTMENT SINK	N.I.C.
11.	WALL SHELVES (2)	ALTERNATE 1 $_____
12.	CLEAN DISH TABLE	ALTERNATE 1 $_____
13.	WALL SHELF	ALTERNATE 1 $_____
14.	DISH MACHINE	ALTERNATE 1 $_____
15.	SOILED DISH TABLE	ALTERNATE 1 $_____
16.	RACK SHELF	ALTERNATE 1 $_____
17.	TRASH CAN	N.I.C.
18.	ICE MACHINE	N.I.C.
19.	WORK TABLE	BASE BID $_____
20.	DROP-IN DUMP SINK	BASE BID $_____
21.	COFFEE MAKER	BY VENDOR
22.	TEA BREWER	BY VENDOR
23.	REFRIGERATOR	N.I.C.
24.	HOOD W/FIRE PROTECTION SYSTEM	BY H.V.A.C.
25.	DUCT AND FAN	BY H.V.A.C.
26.	ST. ST. WALL PANELING	BY H.V.A.C.

ITEM NUMBER	ITEM DESCRIPTION	ITEM PRICE
27.	COMBI OVEN	ALTERNATE 1 $_____
28.	TILT SKILLET	ALTERNATE 1 $_____
29.	TRENCH DRAIN	BASE BID $_____
30.	RANGE	ALTERNATE 1 $_____
31.	WORK TABLE	N.I.C.
32.	HANGING UTENSIL RACK	ALTERNATE 1 $_____
33.	HOT HOLDING CABINET	ALTERNATE 1 $_____
34.	MICROWAVE	N.I.C.
35.	COUNTER W/PREP SINK	BASE BID $_____
36.	WALL SHELF	BASE BID $_____
37.	SLICER	SUPPLY CHANNELS $_____
38.	DROP-IN HOT FOOD UNIT	BASE BID $_____
39.	DROP-IN COLD PAN	BASE BID $_____
40.	PROTECTOR GUARD	BASE BID $_____
41.	MOP SINK	BY G.C.
42.	MOP RACK	BY G.C.
43.	SPARE NUMBER.	
44.	TRAY & SILVER CART	SUPPLY CHANNELS $_____
45.	BEVERAGE TABLE	BY OWNER
46.	AIR POTS (1) LOT	BY OWNER
47.	TEA DISPENSERS (1) LOT	BY OWNER

END OF SECTION

SECTION 12 2113 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Horizontal louver blinds, aluminum slats.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Horizontal louver blinds, aluminum slats.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Rated capacities, operating characteristics, and furnished accessories.

C. Shop Drawings: For horizontal louver blinds.

1. Fabrication and installation details.

D. Samples for Verification: Actual sample of finished products for each type and color of horizontal louver blind.

1. Size: Not less than 4 inches long.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For horizontal louver blinds.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Horizontal Louver Blinds: Full-size units equal to 5 percent of quantity installed for each size, color, texture, pattern, and gloss indicated, but no fewer than two units. Include brackets.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds 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 horizontal louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds 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.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of motorized products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of motorized operating system components.

2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain horizontal louver blinds from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Window Covering Safety Standard: Provide horizontal louver blinds that comply with WCMA A100.1.

2.3 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

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

1. Levolor Contract.
2. Hunter Douglas Contract.
3. Springs Window Fashions.

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.

1. Width: 1 inch.
2. Thickness: Manufacturer's standard, Not less than 0.006 inch.
3. Spacing: Manufacturer's standard.
4. Finish: Ionized antistatic, dust-repellent, baked polyester finish .

C. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.

1. Type: Manufacturer's standard, Braided cord.

D. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose control mechanisms on three sides.

1. Capacity: One and Two blind(s) per headrail (Refer to Drawings – Keynotes on Floor Plan)
2. Ends: Manufacturer's standard, Capped or plugged.

E. Manual Corded Operation:

1. Lift Mechanism:

a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within blind full operating range.

2. Lift Operator: Extension of inner lift cord(s) through lift-cord lock mechanism to form lift cord.
3. Lift Cord: Manufacturer's standard braided cord.
4. Lift-Cord Length: Accessible cord, not greater than 40 percent of product height when blind is fully closed, with cord cleat or Length required to extend to 60 inches above floor level when blind is fully closed.
5. Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
6. Tilt Position: Full.
7. Tilt Operator: Clear-plastic wand Dual cord, with cord cleat.
8. Tilt Over-Rotation Protection: Manufacturer's detachable operator or slip clutch to prevent over-rotation of gear.
9. Lift-Cord and Tilt-Operator Locations: Right side.

2.4 FABRICATION OF HORIZONTAL LOUVER BLINDS

A. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch, plus or minus 1/8 inch.

a. Single Blind – Inside Mount (Refer to Drawings – Keynotes on Floor Plan)
b. Double Blinds – Inside Mount On One Headrail - (Refer to Drawings – Keynotes on Floor Plan)

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

C. Mounting Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind mounting method indicated.

D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

E. Color-Coated Finish:

1. Metal: For components exposed to view, unless anodized or plated finish is indicated, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

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 INSTALLATION OF HORIZONTAL LOUVER BLINDS

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units in accordance with manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than 2 inches from interior faces of glass and not closer than 1-1/2 inches from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation in accordance with manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 12 2113

SECTION 12 3661.16 - 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.
4. Solid surface material sinks.
5. Vanity mounting brackets.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

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 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 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.

1.5 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.

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: 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 levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: 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.

E. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS: (SS-1, SS-2)

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Basis of Design: Corian

    a. Refer to “Interior Finish Key” in Drawings for manufacturer.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following as Listed in “Interior Finish Key” in Drawings:

    1) Corian
    2) Wilsonart
    3) Formica

3. Type: Provide Standard type unless Special Purpose type is indicated.
4. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124. (SS-2)

    a. Sink Model: Refer to “Interior Finish Key” in Drawings for manufacturer.

5. Colors and Patterns: Refer to “Interior Finish Key” in Drawings

B. Particleboard: ANSI A208.1, Grade M-2 or Better.

2.2 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: Premium.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops:

1. 1/2-inch- thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch or 3/4 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.
2. Install integral sink bowls in countertops in the shop.

F. Joints:

1. Fabricate countertops in sections for joining in field.

a. 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.
b. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

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 solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

C. Metal Support Brackets:

1. Manufacturers: Subject to compliance with requirements, Basis of Design:

a. Rakks:

1) Vanity Support Bracket – ADA Compliant (18”x21-1/2”) supports countertops up to 24” deep.

a) Finish: Mill (Unfinished)
b) Spacing: per drawings

b. Provide product by one of the following manufacturers or equal:

1) Rakks
2) A&M Hardware Inc.
3) Counter Balance

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. 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 manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. 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.

F. 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.

G. 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.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION 12 3661.16

SECTION 13 3419 - METAL BUILDING SYSTEMS (ALTERNATE NO. 2)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal wall panels.
2. Thermal insulation at underside of existing roof.
3. Personnel doors and frames.
4. Accessories.

B. Related Requirements:

1. Section 01 2300 "Alternates" – all work in this section is part of Alternate No. 2
2. Section 08 3613 "Sectional Doors" for sectional vehicular doors in metal building systems.

1.2 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.3 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 03 3000 "Cast-in-Place Concrete."

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1. Review methods and procedures related to metal building systems including, but not limited to, the following:

   a. Condition of foundations and other preparatory work performed by other trades.
   b. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

   a. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Metal wall panels.
b. Thermal insulation and vapor-retarder facings.
c. Louvers.

B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:

1. Metal Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

a. Show wall-mounted items including personnel doors, vehicular doors, louvers, and lighting fixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal building system components from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Primary-Frame Type: existing to remain.

C. End-Wall Framing: existing to remain

D. Secondary-Frame Type: existing to remain

E. Eave Height: As indicated on Drawings .

F. Bay Spacing: As indicated on Drawings .

G. Roof Slope: existing to remain, slope as indicated on Drawings .

H. Roof System: existing to remain

I. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib, metal wall panels.

2.3 PERFORMANCE REQUIREMENTS

1. New replacement materials shall match existing components

2.4 METAL WALL PANELS

A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Match existing profile.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Exterior Finish: Two-coat fluoropolymer .
    b. Color: As indicated by manufacturer's designations

2. Major-Rib Spacing: match existing
3. Panel Coverage: match existing
4. Panel Height: match existing

B. Finishes:

1. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

2.5 THERMAL INSULATION

A. Location: continuous at underside of existing metal roof.

B. Retainer Strips: For securing insulation between supports, 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

C. Vinyl Backed Fiberglass Roof Insulation: 2.5” with white finish.

D. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02 perm when tested according to ASTM E96/E96M, Desiccant Method.

1. Composition:

    a. White film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.

E. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.6 PERSONNEL DOORS AND FRAMES

A. Swinging Personnel Doors and Frames:

1. As specified in Section 08 1113 "Hollow Metal Doors and Frames."

2.7 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

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.

B. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [**0.018-inch**] nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

D. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.

E. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch nominal uncoated steel thickness; finished to match metal wall panels. Form blades from zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.036-inch nominal uncoated steel thickness; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.

1. Blades: match existing

    a. Fixed.
    b. Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.

2. Free Area: replace existing with equal louver
3. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.

F. Materials:

1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
2. Fasteners for Metal Wall Panels:

a. Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws**,** with EPDM sealing washers bearing on weather side of metal panels.

3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless steel rivets.
5. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
6. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
7. Metal Panel Sealants:

a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
b. Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.8 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: existing to remain

D. Secondary Framing: existing to remain

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 METAL PANEL INSTALLATION, GENERAL

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

    a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

3.4 THERMAL INSULATION INSTALLATION

A. General: Install insulation at underside of existing metal roof to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

3.5 DOOR AND FRAME INSTALLATION

A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.

B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:

1. Between Doors and Frames at Jambs and Head: 1/8 inch.
2. At Door Sills with Threshold: 3/8 inch.

C. Door Hardware:

1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 07 9200 "Joint Sealants."

3.6 ACCESSORY INSTALLATION

A. General: 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 for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, 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 and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Tie downspouts to underground drainage system indicated.

D. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

1. 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.
2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 9200 "Joint Sealants" for sealants applied during louver installation.

END OF SECTION 13 3419

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Motors.
2. Packless expansion joints.
3. Sleeves without waterstop.
4. Sleeves with waterstop.
5. Sleeve-seal systems.
6. Grout.
7. Silicone sealants.
8. Escutcheons.
9. Thermometers, bimetallic actuated, lead free.
10. Thermowells, lead free.
11. Pressure gauges, dial type, lead free.
12. Gauge attachments, lead free.

1.2 ACTION SUBMITTALS

A. Product data.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water expansion fittings and loops for plumbing piping intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.

C. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.2 MOTORS

A. Motor Requirements, General:

1. Content includes motors for use on alternating-current power systems of up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
2. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
3. Comply with NEMA MG 1 unless otherwise indicated.

B. Motor Characteristics:

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 ft. above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Polyphase Motors:

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Premium Efficient, as defined in NEMA MG 1.
3. Multispeed Motors: Variable torque.

    a. For motors with 2:1 speed ratio, consequent pole, single winding.
    b. For motors with other than 2:1 speed ratio, separate winding for each speed.

4. Rotor: Random-wound, squirrel cage.
5. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
6. Temperature Rise: Match insulation rating.
7. Insulation: Class F.
8. Code Letter Designation:

    a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
    b. Motors Smaller Than 15 Hp: Manufacturer's standard starting characteristic.

9. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Additional Requirements for Polyphase Motors:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

    a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time-rise pulses produced by pulse-width-modulated inverters.
    b. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
    c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
    d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

E. Single-Phase Motors:

1. Motors larger than 1/20 hp must be one of the following, to suit starting torque and requirements of specific motor application:

    a. Permanent-split capacitor.
    b. Split phase.
    c. Capacitor start, inductor run.
    d. Capacitor start, capacitor run.

2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device will automatically reset when motor temperature returns to normal range.

F. Electronically Commutated Motors:

1. Microprocessor-Based Electronic Control Module: Converts 120 V or 240 V single-phase AC power to three-phase DC power to operate the brushless DC motor.
2. Three-phase power motor module with permanent magnet rotor.
3. Circuit board or digital speed controller/LED display.
4. Building Automation System Interface: Via DC voltage signal or Digital Serial Interface (DSI).

2.3 EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

A. Performance Requirements:

1. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
2. Capability: Provide products and installations that will accommodate maximum axial movement as scheduled or indicated on Drawings.

B. Packless Expansion Joints:

1. Rubber Union Connector Expansion Joints, Lead Free: RUEJLF-01.

    a. Material: Twin reinforced EPDM rubber spheres with external restraining cables.
    b. Minimum Pressure Rating: 150 psig at 170 deg F unless otherwise indicated.
    c. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
    d. End Connections for Greater than NPS 2 (DN 50): Flanged.
    e. End Fittings: Stainless steel.

2.4 SLEEVES AND SLEEVE SEALS

A. Sleeves without Waterstop:

1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
2. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
3. Steel Sheet Sleeves: ASTM A653/A653M, 24 gauge minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.

B. Sleeves with Waterstop:

1. Description: Manufactured PVC/HDPE, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Sleeve-Seal Systems:

1. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

   a. Hydrostatic Seal: 20 psig minimum.
   b. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   c. Pressure Plates: Carbon steel.
   d. Connecting Bolts and Nuts: Carbon steel, with zinc coating, ASTM B633 of length required to secure pressure plates to sealing elements.

D. Grout:

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

E. Silicone Sealants:

1. Silicone Sealant, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.

   a. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

2. Silicone Sealant, S, P, T, NT: Single-component, 25, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.

   a. Standard: ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

2.5 ESCUTCHEONS

A. Escutcheon Types:

1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
3. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

B. Floor Plates:

1. Split Floor Plates: Cast brass with concealed hinge.

2.6 METERS AND GAUGES FOR PLUMBING PIPING

A. Thermometers, Bimetallic Actuated, Lead Free:

1. Standard: ASME B40.200.
2. Connector Type(s): Union joint, adjustable angle; with ASME B1.1 or ASME B1.20.1 screw threads to fit thermowell.
3. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
4. Window: Plain glass.
5. Ring: Stainless steel.
6. Element: Bimetal coil.
7. Pointer: Dark-colored metal.
8. Accuracy: Plus or minus 1.5 percent of span.

B. Thermowells, Lead Free:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: Lead-free copper.
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, or as required to match threaded opening in pipe.
6. Internal Threads: Size and thread type as required to match thermometer mounting threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length to extend to center of pipe.
9. Lagging Extension: Include on thermowells for insulated piping and tubing. Extension is to be of sufficient length to extend beyond finished insulation surface.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

C. Pressure Gauges, Dial Type, Lead Free - Direct Mounted, Metal Case:

1. Standard: ASME B40.100.
2. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Lead-free Bourdon tube.
4. Pressure Connection: Lead-free brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanent scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of span.

D. Gauge Attachments, Lead Free:

1. Snubbers: ASME B40.100, lead-free brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
2. Valves: Lead-free brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION JOINTS, GENERAL

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

3.2 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout or silicone sealant, seal the space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.3 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using grout or silicone sealant, seal space around outside of sleeves. Select to maintain fire resistance of floor/slab/wall.

3.4 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.5 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.6 INSTALLATION OF METERS AND GAUGES

A. Install thermometer with thermowell at each required thermometer location.

B. Install thermowells in vertical position in piping tees.

C. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

D. Install thermowells with extension on insulated piping.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

G. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks.

H. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at most readable position.

I. Install remote-mounted pressure gauges on panel.

J. Install valve and snubber in piping for each pressure gauge for fluids.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.
5. Outlet side of hot-water-balancing valve.
6. Each main hot-water-recirculating line return pipe.

L. Install pressure gauges in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.7 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow space for service and maintenance of meters, gauges, machines, and equipment.

3.8 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gauges to proper angle for best visibility.

3.9 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:

1. Perform the following tests and inspections:

    a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
    b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.10 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:

    a. Sleeves with waterstops.

2. Concrete Slabs-on-Grade:

    a. Sleeves with waterstops.

3. Concrete Slabs above Grade:

    a. Sleeves with waterstops.

4. Interior Wall and Partitions:

    a. Sleeves without waterstops.

3.11 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping and Relocated Existing Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Chrome-Plated Piping: One piece, steel with polished, chrome-plated finish.
3. Insulated Piping:

    a. One piece, steel with polished, chrome-plated finish.

4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:

    a. One piece, steel with polished, chrome-plated finish.

5. Bare Piping at Ceiling Penetrations in Finished Spaces:

    a. One piece, steel with polished, chrome-plated finish.

B. Escutcheons for Existing Piping to Remain:

1. Chrome-Plated Piping: Split casting, stamped steel with concealed hinge with polished, chrome-plated finish.
2. Insulated Piping: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
5. Bare Piping in Unfinished Service Spaces: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.
6. Bare Piping in Equipment Rooms: Split plate, stamped steel with concealed or exposed-rivet hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping and Relocated Existing Piping: One piece, floor plate.
2. Existing Piping: Split floor plate.

END OF SECTION

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Butterfly valves.
3. Check valves.
4. Gate valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer.

C. FKM: Fluoroelastomer.

D. NBR: Nitrile butadiene rubber (also known as Buna-N).

E. NRS: Nonrising stem.

F. OS&Y: Outside screw and yoke.

G. PTFE: Polytetrafluoroethylene.

H. RPTFE: Reinforced polytetrafluoroethylene.

I. RS: Rising stem.

1.3 ACTION SUBMITTALS

A. Product data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic-water piping valves intended to convey or dispense water for human consumption must comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372; or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for cast-copper solder-joint connections.
6. ASME B16.22 for wrought-copper solder-joint connections.
7. ASME B16.34 for flanged- and threaded-end connections.
8. ASME B16.51 for press joint connections.
9. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

H. Valve Actuator Type:

1. Gear Actuator: For quarter-turn ball valves NPS 4 and larger.
2. Hand Lever: For quarter-turn ball valves smaller than NPS 4.

I. Valves in Insulated Piping:

1. Provide 2-inch extended neck stems.
2. Provide extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Provide memory stops that are fully adjustable after insulation is applied.

2.2 BALL VALVES, LEAD FREE

A. Ball Valves, Lead Free, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Brass Trim:

1. Standards: MSS SP-110 and MSS SP-145.
2. CWP Rating: 600 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass.
5. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
6. Seats: PTFE.
7. Stem: Brass.
8. Ball: Chrome-plated brass.
9. Port: Full.

B. Ball Valves, Lead Free, Threaded or Soldered Ends - Bronze, Two Piece with Full Port and Bronze or Brass Trim:

1. Standards: MSS SP-110 and MSS SP-145.
2. CWP Rating: 600 psig.
3. Body Design: Two piece.
4. Body Material: Bronze.
5. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
6. Seats: PTFE.
7. Stem: Bronze or brass.
8. Ball: Chrome-plated brass.
9. Port: Full.

2.3 BALL VALVES, GENERAL PURPOSE

A. Ball Valves, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Brass Trim:

1. Standard: MSS SP-110.
2. CWP Rating: 600 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass.
5. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
6. Seats: PTFE.
7. Stem: Brass.
8. Ball: Chrome-plated brass.
9. Port: Full.

B. Ball Valves, Threaded Ends - Bronze, Two Piece, Safety Exhaust:

1. Standards: MSS SP-110 and MSS SP-145.
2. CWP Rating: 200 psig or other pressure. See Part 3 ball valve schedule articles.
3. Body Design: Two piece.
4. Body Material: Bronze, ASTM B584, Alloy C844.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Chrome-plated brass, with exhaust vent opening for pneumatic applications.
9. Port: Full.

C. Ball Valves, Flanged Ends - Iron, Class 125:

1. Standard: MSS SP-72.
2. CWP Rating: 200 psig.
3. Body Design: Split body.
4. Body Material: ASTM A126, gray iron.
5. Ends: Flanged.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel.
9. Port: Full.

2.4 BUTTERFLY VALVES, LEAD FREE

A. Butterfly Valves, Lead Free, Single Flange (Lug Type) - Iron, with Aluminum-Bronze Disc:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig, or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Aluminum bronze.

B. Butterfly Valves, Lead Free, Single Flange (Lug Type) - Iron, with Ductile-Iron Disc:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig, or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Nickel-plated or coated ductile iron.

C. Butterfly Valves, Lead Free, Flangeless (Wafer Type) - Iron, with Aluminum-Bronze Disc:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
6. Stem: One- or two-piece stainless steel.
7. Disc: Aluminum bronze.

D. Butterfly Valves, Lead Free, Grooved End - Ductile Iron, 175 CWP:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 175 psig.
3. Body Material: Coated, ductile iron.
4. Ends: Grooved.
5. Stem: Two-piece stainless steel.
6. Disc: Coated, ductile iron.
7. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.

E. Butterfly Valves, Lead Free, Grooved End - Ductile Iron, 300 CWP:

1. Standard: MSS SP-67, Type I.
2. CWP Rating, NPS 8 (DN 200) and Smaller: 300 psig.
3. Body Material: Coated, ductile iron.
4. Ends: Grooved.
5. Stem: Two-piece stainless steel.
6. Disc: Coated, ductile iron.
7. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.

2.5 BUTTERFLY VALVES, GENERAL PURPOSE

A. Butterfly Valves, Single Flange (Lug Type) - Iron, with Aluminum-Bronze Disc:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: NBR.
6. Stem: One- or two-piece stainless steel.
7. Disc: Aluminum bronze.

B. Butterfly Valves, Single Flange (Lug Type) - Iron, with Ductile-Iron Disc:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: NBR.
6. Stem: One- or two-piece stainless steel.
7. Disc: Nickel-plated[**or -coated**] ductile iron.

C. Butterfly Valves, Flangeless (Wafer Type) - Iron, with Aluminum-Bronze Disc:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: NBR.
6. Stem: One- or two-piece stainless steel.
7. Disc: Aluminum bronze.

D. Butterfly Valves, Flangeless (Wafer Type) - Iron, with Ductile-Iron Disc:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 150 psig or 200 psig. See Part 3 butterfly valve schedule articles.
3. Body Design: Flangeless (wafer type), suitable for bidirectional dead-end service at rated pressure.
4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
5. Seat: NBR.
6. Stem: One- or two-piece stainless steel.
7. Disc: Nickel-plated[**or -coated**] ductile iron.

E. Butterfly Valves, Grooved End - Ductile Iron, 175 CWP:

1. Standard: MSS SP-67, Type I.
2. CWP Rating: 175 psig.
3. Body Material: Coated, ductile iron.
4. Ends: Grooved.
5. Stem: Two-piece stainless steel.

6. Disc: Coated, ductile iron.
7. Seat: NBR.

F. Butterfly Valves, Grooved End - Ductile Iron, 300 CWP:

1. Standard: MSS SP-67, Type I.
2. CWP Rating, NPS 8 (DN 200) and Smaller: 300 psig.
3. Body Material: Coated, ductile iron
4. Ends: Grooved.
5. Stem: Two-piece stainless steel.
6. Disc: Coated, ductile iron.
7. Seat: NBR.

2.6 CHECK VALVES, LEAD FREE

A. Check Valves, Lead Free, Swing Type, Threaded or Soldered Ends - Bronze, with Nonmetallic Disc, Class 125:

1. Standard: MSS SP-80, Type 4.
2. CWP Rating: 200 psig.
3. Body Design: Horizontal flow.
4. Body Material: ASTM B62, bronze.
5. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
6. Disc: PTFE.

B. Check Valves, Lead Free, Swing Type, Press Ends - Bronze:

1. Standards: MSS SP-80 and MSS SP-139.
2. CWP Rating: Minimum 200 psig.
3. Body Design: Horizontal flow.
4. Body Material: ASTM B584, bronze.
5. Ends: Press.
6. Press-End Connections Rating: Minimum 200 psig.
7. Disc: Brass or bronze.

C. Check Valves, Lead Free, Swing Type, Flanged or Threaded Ends - Iron, with Metal Seats, Class 125:

1. Standard: MSS SP-71, Type I.
2. CWP Rating: 200 psig.
3. Body Design: Clear or full waterway.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged or threaded. See Part 3 check valve schedule articles.
6. Trim: Bronze.
7. Gasket: Asbestos free.

D. Check Valves, Lead Free, Swing Type, Flanged or Threaded Ends - Iron, with Metal Seats, Class 250:

1. Standard: MSS SP-71, Type I.
2. CWP Rating: 500 psig.
3. Body Design: Clear or full waterway.

4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged or threaded. See Part 3 check valve schedule articles.
6. Trim: Bronze.
7. Gasket: Asbestos free.

2.7 CHECK VALVES, GENERAL PURPOSE

A. Check Valves, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 125:

1. Standard: MSS SP-80, Type 3.
2. CWP Rating: 200 psig.
3. Body Design: Horizontal flow.
4. Body Material: ASTM B62, bronze.
5. Ends: Threaded or soldered ends. See Part 3 check valve schedule articles.
6. Disc: Bronze.

B. Check Valves, Swing Type, Flanged Ends - Iron, with Metal Seats, Class 125:

1. Standard: MSS SP-71, Type I.
2. CWP Rating, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 psig.
3. CWP Rating, NPS 14 to NPS 24 (DN 350 to DN 600): 150 psig.
4. Body Design: Clear or full waterway.
5. Body Material: ASTM A126, gray iron with bolted bonnet.
6. Ends: Flanged.
7. Trim: Bronze.
8. Gasket: Asbestos free.

2.8 GATE VALVES, LEAD FREE

A. Gate Valves, Lead Free, Threaded or Soldered Ends - Bronze, NRS, Class 125:

1. Standard: MSS SP-80, Type 1.
2. CWP Rating: 200 psig.
3. Body Material: Bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint. See Part 3 gate valve schedule articles.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze or aluminum

B. Gate Valves, Lead Free, Threaded or Soldered Ends - Bronze, RS, Class 125:

1. Standard: MSS SP-80, Type 2.
2. CWP Rating: 200 psig.
3. Body Material: Bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint. See Part 3 gate valve schedule articles.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

C. Gate Valves, Lead Free, Press Ends - Bronze:

1. Standards: MSS SP-80 and MSS SP-139.
2. CWP Rating: Minimum 200 psig.
3. Body Material: Bronze with integral seat and union-ring bonnet.
4. Ends: Press.
5. Press Ends Connection Rating: Minimum 200 psig.
6. Stem: Brass or bronze, RS or NRS. See Part 3 gate valve schedule articles.
7. Disc: Solid wedge, bronze.
8. Packing: Graphite.
9. Port: Full.
10. Handwheel: Malleable iron, bronze, or aluminum.

D. Gate Valves, Lead Free, Flanged Ends - Iron, NRS, Class 125:

1. Standard: MSS SP-70, Type I.
2. CWP Rating: 200 psig.
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

DI. Gate Valves, Lead Free, Flanged Ends - Iron, OS&Y, Class 125:

1. Standard: MSS SP-70, Type I.
2. CWP Rating: 200 psig.
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flange.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

DII. Gate Valves, Lead Free, Flanged Ends - Iron, NRS, Class 250:

1. Standard: MSS SP-70, Type I.
2. CWP Rating: 500 psig.
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flange.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

DIII. Gate Valves, Lead Free, Flanged Ends - Iron, OS&Y, Class 250:

1. Standard: MSS SP-70, Type I.
2. CWP Rating: 500 psig.
3. Body Material: Gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

2.9 GATE VALVES, GENERAL PURPOSE

A. Gate Valves, Threaded or Soldered Ends - Bronze, NRS, Class 125:

1. Standard: MSS SP-80, Type 1.
2. CWP Rating: 200 psig.
3. Body Material: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or soldered joint. See Part 3 gate valve schedule articles.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron**,** bronze or aluminum.

B. Gate Valves, Threaded or Soldered Ends - Bronze, RS, Class 125:

1. Standard: MSS SP-80, Type 2.
2. CWP Rating: 200 psig.
3. Body Material: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or soldered joint. See Part 3 gate valve schedule articles.
5. Stem: Bronze.
6. Disc: Solid wedge, bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

C. Gate Valves, Flanged Ends - Iron, NRS, Class 125:

1. Standard: MSS SP-70, Type I.
2. CWP Rating, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 psig.
3. CWP Rating, NPS 14 to NPS 24 (DN 350 to DN 600): 150 psig.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Disc: Solid wedge.
8. Packing and Gasket: Asbestos free.

D. Gate Valves, Flanged Ends - Iron, OS&Y, Class 125:

1. Standard: MSS SP-70, Type I.
2. CWP Rating, NPS 2-1/2 to NPS 12 (DN 65 to DN 300): 200 psig.
3. CWP Rating, NPS 14 to NPS 24 (DN 350 to DN 600): 150 psig.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Disc: Solid wedge.
8. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide support of piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position that does not project into aisles or block access to other equipment.

F. Install valves in position to allow full stem and actuator or manual operator movement.

G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.

H. Install check valves for proper direction of flow and as follows:

1. Check Valves, Swing Type: In horizontal position with hinge pin level.

I. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

J. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's written recommended maximum.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
7. For Grooved-End Copper Tubing: Valve ends may be grooved.
8. For Grooved-End Steel Piping: Valve ends may be grooved.
9. Wafer-Type Valves: Flanged connections.

3.3 DOMESTIC HOT- AND COLD-WATER BALL VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball valves, lead free, threaded ends - brass, one piece.
2. Ball valves, lead free, threaded or soldered ends - brass, two piece with full port and brass trim; soldered ends.
3. Ball valves, lead free, press ends - brass, two piece with full port and brass trim.
4. Ball valves, lead free, threaded or soldered ends - brass, two piece with regular port and brass trim; soldered ends.
5. Ball valves, lead free, threaded ends - bronze, one piece with bronze trim.

6. Ball valves, lead free, threaded or soldered ends - bronze, two piece with full port and bronze or brass trim; soldered ends.
7. Ball valves, lead free, press ends - bronze, two piece with full port and bronze or brass trim.
8. Ball valves, lead free, threaded ends - bronze, two piece with regular port and bronze or brass trim.
9. Ball valves, lead free, flanged or threaded ends - steel, with full port, Class 150; threaded flanged ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Ball valves, lead free, flanged or threaded ends - iron, Class 125; flanged threaded ends.
2. Ball valves, lead free, flanged or threaded ends - steel, with full port, Class 150; flanged threaded ends.
3. Ball valves, lead free, flanged or threaded ends - steel, with regular port, Class 150; flanged threaded ends.

3.4 DOMESTIC HOT- AND COLD-WATER BUTTERFLY VALVE SCHEDULE

A. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Butterfly valves, lead free, single flange (lug type) - iron, with aluminum-bronze disc; 150 CWP, EPDM seat.
2. Butterfly valves, lead free, single flange (lug type) - iron, with ductile-iron disc; 150 CWP, EPDM seat.
3. Butterfly valves, lead free, flangeless (wafer type) - iron, with aluminum-bronze disc; 150 CWP, EPDM seat.
4. Butterfly valves, lead free, flangeless (wafer type) - iron, with ductile-iron disc; 150 CWP, EPDM seat.
5. Butterfly valves, lead free, grooved end - ductile iron, 175 CWP; EPDM seat.
6. Butterfly valves, lead free, grooved end - ductile iron, 300 CWP; EPDM seat.

3.5 DOMESTIC HOT- AND COLD-WATER CHECK VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125; soldered ends.
2. Check valves, lead free, swing type, threaded or soldered ends - bronze, with nonmetallic disc, Class 125; soldered ends.
3. Check valves, lead free, swing type, press ends - bronze.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Check valves, lead free, swing type, flanged or threaded ends - iron, with metal seats, Class 125; flanged threaded ends.
2. Check valves, lead free, swing type, flanged or threaded ends - iron, with nonmetallic-to-metal Seats, Class 125; flanged threaded ends.
3. Check valves, lead free, swing type, flanged or threaded ends - iron, with metal seats, Class 250; flanged threaded ends.
4. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever- and spring-closure control, Class 125; flanged threaded ends.
5. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever- and weight-closure control, Class 125; flanged threaded ends.
6. Check valves, lead free, swing type, grooved ends - iron, 300 CWP.

3.6 DOMESTIC HOT- AND COLD-WATER GATE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Gate valves, lead free, threaded or soldered ends - bronze, NRS, Class 125; soldered ends.
2. Gate valves, lead free, threaded or soldered ends - bronze, RS, Class 125; soldered ends.
3. Gate valves, lead free, threaded ends - bronze, NRS, Class 150.
4. Gate valves, lead free, threaded ends - bronze, RS, Class 150.
5. Gate valves, lead free, press ends - bronze.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Gate valves, lead free, flanged ends - iron, NRS, Class 125.
2. Gate valves, lead free, flanged ends - iron, OS&Y, Class 125.
3. Gate valves, lead free, flanged ends - iron, NRS, Class 250.
4. Gate valves, lead free, flanged ends - iron, OS&Y, Class 250.

END OF SECTION

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 FASTENER SYSTEMS

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

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

2.4 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

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

B. Grout: ASTM C 1107, factory-mixed and packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

C. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

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

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

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. Brady Corporation.
    b. Brimar Industries, Inc.
    c. Seton Identification Products.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. Minimum Letter Size: 3/4 inch for name of units if viewing distance is less than 24 inches, 3/4 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 3/4 inch for name of units if viewing distance is less than 24 inches, ¾ inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 3/4 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Domestic Water Piping

    a. Background: Blue
    b. Letter Colors: White.

2. Sanitary Waste and Vent Piping:

    a. Background Color: Black
    b. Letter Color: White.

3. Natural Gas Piping

    a. Background Color: Yellow
    b. Letter Color: Black

END OF SECTION

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.
3. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

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

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

2.2 ADHESIVES

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

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

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. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Knauf Insulation.
c. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Knauf Insulation.
    c. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

2.5 SECUREMENTS

A. Wire: 0.062-inch soft-annealed, stainless steel.

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. C & F Wire.

2.6 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

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. Just Manufacturing.
    b. Plumberex Specialty Products, Inc.
    c. Truebro.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

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

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold: Insulation shall be the following:

1. Flexible Elastomeric: 0.5 inch thick.

B. Domestic Hot and Recirculated Hot water: Insulation shall be the following.
1. Flexible Elastomeric:
   a. Pipe Size: 0.5” to < 1-1/2”: 1 inch thick
   b. Pipe Size: 1-1/2” to < 4” = 1-1/2 inch thick

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:

1. Flexible Elastomeric: 1 inch thick.

END OF SECTION

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.
4. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.

3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Nipples (Waterways):

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. Elster Perfection Corporation.
b. Sioux Chief Manufacturing Company, Inc.
c. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level without pitch and plumb.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 4 and Smaller: Use dielectric nipples.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.

7. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water piping,, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

END OF SECTION

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temperature-actuated, water mixing valves.
2. Water-hammer arresters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

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. Cash Acme, A Division of Reliance Worldwide Corporation.
    b. WATTS.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1017.

3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F.
9. Valve Finish: Rough bronze.

2.4 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

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. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. WATTS.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

B. Install water-hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 ADJUSTING

A. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 221123.21 - INLINE, DOMESTIC-WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.
2. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.2 ACTION SUBMITTALS

A. Product data.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: UL 778 for motor-operated water pumps.

C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

B. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Minimum Working Pressure: 125 psig.
3. Maximum Continuous Operating Temperature: 220 deg F.
4. Casing: Cast iron, with threaded or companion-flange connections.
5. Impeller: Plastic composite or stainless steel.
6. Motor: Single speed.

2.3 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Description: Factory-assembled and tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

B. Pump Construction:

1. Casing:

   a. Radially split bronze or cast iron with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
   b. Built to permit servicing of pump internals without disturbing the casing or the suction and discharge piping.
   c. Gauge port tappings at suction and discharge nozzles.

2. Impeller: Bronze or brass, statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
4. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
5. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
6. Bearings: Grease-lubricated or permanently lubricated ball type.
7. Minimum Working Pressure: 175 psig.
8. Continuous Operating Temperature: 225 deg F.

C. Motor: Single speed, with grease-lubricated ball bearings; resiliently or rigidly mounted to pump casing.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220500 "Common Work Results for Plumbing."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.5 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V ac.

B. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
3. Operation of Pump: On or off.

4. Transformer: Provide if required.
5. Power Requirement: 120 V ac.
6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with HI 1.4.

B. Mount pumps in orientation complying with manufacturer's written instructions.

C. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.

1. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

D. Install thermostats in hot-water return piping.

E. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

F. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats and timers for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.

C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

    a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
    b. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties." Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

    1. Install pressure gauge at suction of each pump and pressure gauge at discharge of each pump. Install at integral pressure-gauge tappings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 220500 "Common Work Results for Plumbing."

3.3 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between temperature controllers and devices.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

    1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
    2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.4 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company, LLC; a division of MCP Industries.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Dielectric Fittings:

1. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Watts; a Watts Water Technologies company.
2) Wilkins.
3) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric-Flange Insulating Kits:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Advance Products & Systems, Inc.
2) Calpico, Inc.
3) Pipeline Seal and Insulator, Inc.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Install aboveground PVC piping according to ASTM D 2665.

O. Install underground PVC piping according to ASTM D 2321.

P. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

Q. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

B. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

C. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.

2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
5. NPS 6: 10 feet with 5/8-inch rod.
6. NPS 8: 10 feet with 3/4-inch rod.

G. Install supports for vertical copper tubing every 10 feet.

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

I. Install supports for vertical PVC piping every 48 inches.

J. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves.
6. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Aboveground, soil, waste, and vent piping not in HVAC plenums shall be any of the following:

1. Copper Type DWV tube, copper drainage fittings, and soldered joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

B. Aboveground, soil, waste, and vent piping in HVAC plenums shall be any of the following:

1. Copper Type DWV tube, copper drainage fittings, and soldered joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. PVC in plenums shall be wrapped with fiberglass insulation with all-service jacket listed for such use, with

flame spread rating of 25 or less and smoke developed rating of 50 or less in accordance with ASTM E84.

3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Underground, soil, waste, and vent piping shall be any of the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. PVC: Polyvinyl chloride.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

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. Mifab

b. JR Smith

c. Watts

d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: 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. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Mifab

    c. Watts

    d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

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. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

    a. Brass.
    b. Countersunk head.
    c. Drilled and threaded for cover attachment screw.
    d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

F. Install wood-blocking reinforcement for wall-mounting-type specialties.

G. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor drains.
2. Floor sinks.
3. Trench drains.

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Plastic Floor Drains:

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. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Sioux Chief Manufacturing Company, Inc.
c. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Material: PVC.
4. Outlet: Bottom.
5. Top or Strainer Material: Bronze.
6. Top of Body and Strainer Finish: Nickel bronze.
7. Top Shape: Round.
8. Trap Material: Plastic drainage piping.
9. Trap Pattern: Standard P-trap.

2.3 FLOOR SINKS

A. Plastic Floor Sinks:

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. Zurn Industries, LLC.
    b. Oatey Co.
    c. Sioux Chief Manufacturing Company, Inc.

2. Standard: ASME A112.6.7.
3. Body Material: PVC.
4. Outlet: Bottom, PVC primer and solvent cement, connection.
5. Sediment Bucket: Not required.
6. Internal Strainer: Not required.
7. Top Grate Material: PVC.
8. Top Shape: Square.
9. Top Loading Classification: 1,000 Lbs

2.4 TRENCH DRAINS

A. Trench Drains <Insert drawing designation if any>:

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. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. WATTS; A Watts Water Technologies Company.
    c. Zurn Industries, LLC.

2. Standard: ASME A112.6.3 for trench drains.
3. Material: Stainless Steel
4. Flange: Membrane
5. Outlet: Bottom.
6. Grate Material: Stainless steel.
7. Grate Finish: Stainless Steel
8. Dimensions of Frame and Grate: Linear drain with membrane flange and drop in outlet. 3” wide slotted grate. Shower
9. Trap Material: Plastic drainage piping.
10. Trap Pattern: Standard P-trap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.
2. Install on support devices, so that top will be flush with adjacent surface.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 221323 - SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interceptors, grease.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sanitary waste interceptor.

B. Shop Drawings: For each type and size of precast-concrete sanitary waste interceptor.

1. Materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Piping connections. Include size, location, and elevation of each.
2. Interface with underground structures and utility services.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste interceptors to include in emergency, operation, and maintenance manuals.

1.5 FIELD CONDITIONS

A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services in accordance with requirements indicated:

1. Notify Construction Manager Owner no fewer than seven Insert number days in advance of proposed interruption of service.
2. Do not proceed with interruption of sewer services without Construction Manager's Owner's written permission.

PART 2 - PRODUCTS

2.1 INTERCEPTORS, GREASE

A. Interceptors, Grease - Plastic:

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. MIFAB, Inc.
    b. Schier Products Company.
    c. Zurn Industries, LLC.

2. Standard:

    a. PDI G101.
    b. ASME A112.14.3.

3. PDI Seal: Required.
4. Description: Factory-fabricated grease interceptor for intercepting and retaining FOG from food-preparation wastewater.
5. Body Material: Plastic.
6. Inlet, Outlet, and Vent Piping Connections: Hub, or no-hub (hubless) unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION OF SANITARY WASTE INTERCEPTORS

A. Equipment Mounting:

B. Set interceptors level and plumb.

C. Set tops of grating frames and grates flush with finished surface.

D. Set metal and plastic interceptors level and plumb.

E. Set tops of metal interceptor covers flush with finished surface in pavements.

F. Install captured waste oil piping and waste oil storage tanks in accordance with the requirements of the Authority Having Jurisdiction.

G. Install grease interceptors, including trapping, venting, and flow-control fitting, in accordance with authorities having jurisdiction and with clear space for servicing.
    1. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
    2. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

3.2 PIPING CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.3 IDENTIFICATION

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Grease interceptors.

3.4 PROTECTION

A. Protect sanitary waste interceptors from damage during construction period.

B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION

SECTION 223100 - DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water softeners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for water softeners, accessories, and components, from manufacturer.

B. Source quality-control reports.

C. Field quality-control reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of water softeners that fail in materials or workmanship within specified warranty period.

1. Water Softeners, Warranty Period: From date of Substantial Completion.

a. Mineral Tanks: Five years.
b. Brine Tanks: 5 years.
c. Control Valve: 5 year(s).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

2.2 WATER SOFTENERS

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

1. Culligan International Company.
2. WATTS; A Watts Water Technologies Company.
3. WaterSoft.

B. Description: Factory-assembled, pressure-type water softener.

1. Configuration: Twin unit with two mineral tanks and one brine tank.
2. Mounting: On skids.
3. Wetted Components: Suitable for water temperatures from 40 to at least 120 deg F.
4. Mineral Tanks: FRP, pressure-vessel quality.

    a. Construction: Non-ASME code.
    b. Pressure Rating: 125 psig minimum.
    c. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
    d. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
    e. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from nonmetallic pipe and fittings with individual, fine-slotted, nonclogging plastic strainers, and arranged for even flow distribution through resin bed.
    f. Liner: PE, ABS, or other material suitable for potable water.
    g. Pressure Rating: 125 psig minimum.
    h. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
    i. Finish: Hot-dip galvanized on exterior and interior of tank after fabrication unless tank is stainless steel.
    j. Liner: PE, ABS, or other material suitable for potable water.

5. Controls: Automatic; 120 V; factory wired and factory mounted on unit.

    a. Adjustable duration of various regeneration steps.
    b. Push-button start and complete manual operation.
    c. Electric time clock and switch for automatic operation except for manual return to service.
    d. Sequence of Operation: Multiport pilot-control valve automatically pressure-actuates main operating valve through steps of regeneration.
    e. Pointer on pilot-control valve shall indicate cycle of operation.
    f. Includes means of manual operation of pilot-control valve if power fails.

6. Controls: Fully automatic; 120 V; factory wired and factory mounted on unit.

    a. Adjustable duration of various regeneration steps.
    b. Push-button start and complete manual operation.

c. Electric time clock and switch for fully automatic operation, adjustable to initiate regeneration at any hour of day and any day of week or at fixed intervals.
d. Sequence of Operation: Multiport pilot-control valve automatically pressure-actuates main operating valve through steps of regeneration and return to service.
e. Pointer on pilot-control valve shall indicate cycle of operation.
f. Includes means of manual operation of pilot-control valve if power fails.

7. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:

a. Slow opening and closing, nonslam operation.
b. Diaphragm guiding on full perimeter from fully open to fully closed.
c. Isolated, dissimilar metals within valve.
d. Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
e. Sampling cocks for soft water.
f. Special tools are not required for service.

8. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressure; does not require field adjustments.
a. Demand-Initiated Control: Each mineral tank of twin mineral-tank unit is equipped with automatic-reset-head water meter that electrically activates cycle controllers to initiate regeneration at preset total in gallons. Head automatically resets to preset total in gallons for next service run. Electrical lockout prevents simultaneous regeneration of both tanks.
b. Demand-Initiated Control: Each twin mineral-tank unit is equipped with automatic-reset-head water meter, in common outlet header, that electrically activates cycle controller to automatically regenerate one mineral tank at preset total in gallons and divert flow to other tank. Automatically repeats with other tank. Electrical lockout prevents simultaneous regeneration of both tanks.

9. Brine Tank: Combination measuring and wet-salt storing system.

a. Tank and Cover Material: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawal and freshwater refill.
c. Size: Large enough for at least four regenerations at full salting.

10. Factory-Installed Accessories:

a. Piping, valves, tubing, and drains.
b. Sampling cocks.
c. Main-operating-valve position indicators.
d. Water meters.

PART 3 - EXECUTION

3.1 INSTALLATION OF WATER SOFTENERS

A. Equipment Mounting:

1. Install water softeners on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

3. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

B. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure.

C. Install brine lines and fittings furnished by equipment manufacturer, but not specified to be factory installed.

D. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

E. Install water-testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance.

C. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.

1. Metal general-duty valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Plastic valves are specified in Section 221116 "Domestic Water Piping."
3. Exception: Water softeners with factory-installed shutoff valves at locations indicated.

D. Install pressure gauges on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gauges are specified in Section 220500 "Common Work Results for Plumbing."

1. Exception: Water softeners with factory-installed pressure gauges at locations indicated.
2. Exception: Household water softeners.
3. Exception: Water softeners in hot-water service.

E. Install valved bypass in water piping around water softeners.

1. Metal general-duty valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Plastic valves are specified in Section 221116 "Domestic Water Piping."
3. Water piping is specified in Section 221116 "Domestic Water Piping."
4. Exception: Water softeners in hot-water service.

F. Install indirect wastes to spill into open drains or pit with drain.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

3.4 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections[with the assistance of a factory-authorized service representative].

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Water softeners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:

1. ASTM D859, "Test Method for Silica in Water."
2. ASTM D1067, "Test Methods for Acidity or Alkalinity of Water."
3. ASTM D1068, "Test Methods for Iron in Water."
4. ASTM D1126, "Test Method for Hardness in Water."
5. ASTM D1129, "Terminology Relating to Water."
6. ASTM D3370, "Practices for Sampling Water from Closed Conduits."

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include three months' full maintenance by skilled employees of water softener Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper water softener operation at rated capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain domestic water softeners.

END OF SECTION

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL (Not Applicable)

1.1 SUMMARY

A. Section Includes:
   1. Commercial, direct-vent, gas-fired, storage, domestic-water heater.
   2. Commercial, grid-type, finned-tube, gas-fired, domestic-water heaters.
   3. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

   1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of commercial, gas-fired, domestic-water heater.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

   1. Warranty Periods: From date of Substantial Completion.

      a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: One year(s).

b. Expansion Tanks: Five years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

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. American Water Heaters.
b. AO Smith.
c. Rheem Manufacturing Company.

2. Standard: ANSI Z21.10.1/CSA 4.1.
3. Storage-Tank Construction: Steel.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal with hose-end connection.
d. Insulation: Comply with ASHRAE/IES 90.1.
e. Jacket: Steel with enameled finish.
f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.
h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
i. Temperature Control: Adjustable thermostat.
j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

5. Direct-Vent System: Through-wall roof, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.

B. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

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. A. O. Smith Corporation.
b. Raypak; a Rheem brand.
c. Rheem Manufacturing Company.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 (DN 50) and Smaller: Threaded ends in accordance with ASME B1.20.1.
2) NPS 2-1/2 (DN 65) and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

5. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal with hose-end connection.
d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as

heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

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. A. O. Smith Corporation.
    b. AMTROL, Inc.
    c. Taco Comfort Solutions.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.

G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.

J. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.

K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 18 inches above the floor.

M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

B. Hydrostatically te**sting** commercial domestic-water heaters and storage tanks minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOMESTIC-WATER HEATER

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters in accordance with NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."

H. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for thermometers specified in Section 220500 "Common Work Results for Plumbing."

I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

J. Fill domestic-water heaters with water.

K. Charge domestic-water expansion tanks with air to required system pressure.

L. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

M. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.2 PIPING CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for fuel-oil piping specified in Section 231113 "Facility Fuel-Oil Piping."

C. Comply with requirements for gas piping specified in [Section 231123 "Facility Natural-Gas Piping."] [Section 231126 "Facility Liquefied-Petroleum Gas Piping."]

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections[with the assistance of a factory-authorized service representative].

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION

SECTION 224200 - COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial lavatories.
2. Commercial showers.
3. Commercial sinks.
4. Commercial urinals.
5. Commercial water closets.
6. Flushometer valves.
7. Toilet seats.
8. Fixture carriers.

B. Related Requirements:

1. Section 114000 "Foodservice Equipment" for NSF-compliant foodservice and handwash sinks.

1.2 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Plans, elevations, sections, and details.
2. Details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories and/or counter-mounted sinks.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lavatory faucets, sink faucets, shower valves, and wash fountain spray heads and faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe

Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

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 COMMERCIAL LAVATORIES

A. Lavatory Faucets, Manually Operated:

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. Elkay.
    b. Moen Incorporated.
    c. Zurn Industries, LLC.

2. Standard: ASME A112.18.1/CSA B125.1.
3. Operation Type: Two handle, mixing, Commercial General duty.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.2 gpm.
8. Mounting Type: Deck, exposed.
9. Valve Handle(s): Wrist blade, 4 inches.
10. Spout: Rigid
11. Spout Outlet: Aerator.
12. Drain: Grid Strainer Drain

B. Lavatory Supply Fittings:

1. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
2. Standard: ASME A112.18.1/CSA B125.1.
3. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
4. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
5. Operation: Loose key.
6. Risers:

    a. NPS 1/2.
    b. ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel, flexible hose riser.

C. Lavatory Waste Fittings:

1. Standard: ASME A112.18.2/CSA B125.2.
2. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
3. Trap:

    a. Size: NPS 1-1/4.

b. Material:

1) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

2.3 COMMERCIAL SHOWERS

A. Shower Valve Assemblies:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Kohler Co.
2) Moen Incorporated.
3) Zurn Industries, LLC.

b. Source Limitations: Obtain shower heads and shower valves from single source from single manufacturer.
c. Description: Single-handle, accessible, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and hose with handheld shower head on sliding rod shower head where indicated.
d. Shower Valve:

1) Standards:

a) ASME A112.18.1/CSA B125.1.
b) ASSE 1016/ASME A112.1016/CSA B125.16.

2) Body Material: Solid brass.
3) Finish: Polished chrome plate.
4) Mounting: Exposed.
5) Operation: Single-handle, twist or rotate control.
6) Antiscald Device: Integral with mixing valve.
7) Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

e. Supply Connections: NPS 1/2.
f. Shower Head:

1) Standard: ASME A112.18.1/CSA B125.1.
2) Type: Ball joint with arm and flange.
3) Shower Head Maximum Flow Rate: 2.25 gpm.
4) Shower Head Material: Metallic with chrome-plated finish.
5) Spray Pattern: Adjustable.
6) Integral Volume Control: Not required.

B. Grout:

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink; recommended for interior and exterior applications.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

2.4 COMMERCIAL SINKS

A. Service Sinks, Floor Mounted:
   1. Service Sinks, Floor Mounted - Molded Stone:

      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

         1) Fiat Products.
         2) Mustee.
         3) Zurn Industries.

      b. Source Limitations: Obtain sinks from single source from single manufacturer.
      c. Fixture:

         1) Standard: ASME A112.18.2/CSA B125.2.
         2) Shape: Square.
         3) Nominal Size: 24 by 24 inches.
         4) Height: 10 inches.
         5) Rim Guard: On all top surfaces.
         6) Drain: Grid with NPS 2 outlet.

      d. Mounting: On floor and flush to wall.
      e. Faucet: Refer to “Manually Operated Sink Faucets” Article

B. Sink Faucets, Manually Operated:

   1. Sink Faucets, Manually Operated - Service Sink:

      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

         1) Chicago Faucets; Geberit Group.
         2) Krowne.
         3) T&S Brass and Bronze Works, Inc.
      b. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch hose thread end, integral vacuum breaker, inlets 8 inches o.c., and two-handle mixing.
      c. Faucet:

         1) Standards:

            a) ASME A112.18.1/CSA B125.1.
            b) NSF 61 and NSF 372.
            c) ICC A117.1.
            d) ASSE 1001 (VB).

         2) Finish: Rough chrome plated.
         3) Handles: Lever
         4) Cartridges: One-fourth turn compression.
      d. Spout Outlet: Aerator.

C. Sink Supply Fittings:

   1. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

2. Standard: ASME A112.18.1/CSA B125.1.
3. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.
4. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
5. Operation: Loose key.
6. Risers:

    a. NPS 3/8.

D. Sink Waste Fittings:

1. Standard: ASME A112.18.2/CSA B125.2.
2. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
3. Trap:

    a. Size: NPS 1-1/2.
    b. Material:

        1) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

E. Grout:

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink; recommended for interior and exterior applications.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

2.5 COMMERCIAL URINALS

A. Urinals, Wall Hung:

1. Urinals, Wall Hung - Back Outlet, Siphon Jet:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

        1) American Standard.
        2) Kohler Co.
        3) Sloan.

    b. Fixture:

        1) Standards:

            a) ASME A112.19.2/CSA B45.1.
            b) ASME A112.19.5/CSA B45.15.

        2) Material: Vitreous china.
        3) Type: Siphon jet.
        4) Strainer or Trapway: Manufacturer's standard strainer with integral trap.
        5) Water Consumption: 1.0 gpf.
        6) Spud Size and Location: NPS 3/4; top.
        7) Outlet Size and Location: NPS 2; back.

8) Color: White.

c. Flushometer Valve: Per urinal flushometer-valve in "Flushometer Valves" Article.
d. Waste Fitting:

1) Standard: ASME A112.18.2/CSA B125.2 for coupling.
2) Size: NPS 2.

e. Support: Urinal carrier, floor affixed with steel uprights with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.

2.6 COMMERCIAL WATER CLOSETS

A. Water Closets, Floor Mounted:

1. Water Closets, Floor Mounted - Bottom Outlet, Top Spud:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) American Standard.
2) Kohler Co.
3) Sloan Valve Company.
b. Standard: ASME A112.19.2/CSA B45.1.
c. Bowl:

1) Material: Vitreous china.
2) Type: Siphon jet.
3) Style: Flushometer valve.
4) Height: Accessible in accordance with ICC A117.1.
5) Rim Contour: Elongated.
6) Water Consumption: 1.6 gal. per flush.
7) Spud Size and Location: NPS 1-1/2; top.
8) Color: White.

d. Flushometer Valve: Per flushometer-valve in "Flushometer Valves" Article.
e. Toilet Seat: Per article “Toilet Seats” in this section.

2.7 FLUSHOMETER VALVES

A. Flushometer Valves, Sensor Operated:

1. Flushometer Valves, Sensor Operated - Diaphragm:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Advanced Modern Technologies Corporation - AMTC.
2) Sloan Valve Company.
3) Zurn Industries, LLC.
b. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
c. Minimum Pressure Rating: 125 psig.
d. Features: Include integral check stop and backflow-prevention device.
e. Material: Brass body with corrosion-resistant components.

f. Style: Exposed.
g. Exposed Flushometer-Valve Finish: Chrome-plated.
h. Actuator: Side or top mounted; listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and application.
i. Trip Mechanism: Hardwired, control-voltage electronic sensor; listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and application.
j. Consumption: 1.6 gal. per flush.
k. Minimum Inlet: NPS 1.
l. Minimum Outlet: NPS 1-1/2.

2.8 TOILET SEATS

A. Toilet Seats <Insert drawing designation>:

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. Bemis Manufacturing Company.
    b. Church Seats; Bemis Manufacturing Company.
    c. Kohler Co.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.
10. Surface Treatment: Not required.

2.9 FIXTURE CARRIERS

A. Fixture Carriers - Urinal:

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. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. WATTS; A Watts Water Technologies Company.
    c. Zurn Industries, LLC.

2. Source Limitations: Obtain urinal carriers from single source from single manufacturer.
3. Standard: ASME A112.6.1M.
4. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings, gaskets, and feet; bolts and hardware matching fixture.

PART 3 - EXECUTION

3.1 INSTALLATION OF COMMERCIAL PLUMBING FIXTURES

A. Lavatory Installation:

1. Install lavatories level and plumb in accordance with roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted lavatories.
3. Install accessible, wall-mounted lavatories at mounting height in accordance with ICC A117.1.
4. Install water-supply piping with stop on each supply to each lavatory faucet. Install stops in locations that are accessible for ease of operation.
5. Install trap and waste piping on each drain outlet of each lavatory to be connected to sanitary drainage system.
6. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
7. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
8. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

B. Shower Installation:

1. Assemble shower components in accordance with manufacturers' written instructions.
2. Install showers level and plumb in accordance with roughing-in drawings.
3. Install ball valves in water-supply piping to the shower if supply stops are specified with the shower valve. Comply with ball valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping." Install valves in locations that are accessible for ease of operation.
4. Install shower flow-control fittings with specified maximum flow rates in shower arms.
5. Set shower receptors and shower basins in leveling bed of cement grout.
6. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
7. Seal joints between showers, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

C. Sink Installation:

1. Install sinks level and plumb in accordance with roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted sinks.
3. Install accessible, wall-mounted sinks at mounting height in accordance with ICC A117.1.
4. Set floor-mounted sinks in leveling bed of cement grout.
5. Install water-supply piping with stop on each supply to each sink faucet.

    a. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping."
    b. Install stops/valves in locations that are accessible for ease of operation.

6. Install trap and waste piping on each drain outlet of each sink to be connected to sanitary drainage system.
7. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
8. Seal joints between sinks, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
9. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

D. Urinal Installation:

1. Install urinals level and plumb in accordance with roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste-fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height in accordance with ICC A117.1.
5. Install trap-seal liquid in waterless urinals.
6. Install supports, affixed to building substrate, for wall-hung urinals.
7. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
8. Use carriers without waste fitting for urinals with tubular waste piping.
9. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
10. Measure support height installation from finished floor, not structural floor.
11. Install flushometer-valve, water-supply fitting on each supply to each urinal.
12. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
13. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
14. Install actuators in locations easily reachable for people with disabilities.
15. Install new batteries in battery-powered, electronic-sensor mechanisms.
16. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
17. Seal joints between urinals, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to urinal color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

E. Water Closet Installation:

1. Install water closets level and plumb in accordance with roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height in accordance with ICC A117.1.
4. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
5. Use carrier supports with waste-fitting assembly and seal.
6. Install floor-mounted, back-outlet water closets, attached to building floor substrate, onto waste-fitting seals; and attach to support.
7. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals, and affix to building substrate.
8. Measure support height installation from finished floor, not structural floor.
9. Install flushometer-valve, water-supply fitting on each supply to each water closet.
10. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
11. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.

12. Install actuators in locations easily reachable for people with disabilities.
13. Install new batteries in battery-powered, electronic-sensor mechanisms.
14. Install toilet seats on water closets.
15. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
16. Seal joints between water closets, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to water-closet color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.2 INSTALLATION OF PIPING CONNECTIONS

A. Connect plumbing fixtures with water supplies and soil, waste, and vent piping. Use size fittings required to match plumbing fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil, waste, and vent piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective-shielding pipe covers and enclosures on exposed supplies and waste piping of accessible plumbing fixtures. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

E. Where installing piping adjacent to water closets and urinals, allow space for service and maintenance.

3.3 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damages finishes. Replace any fixtures unable to be repaired to the satisfaction of the Owner.

B. Clean plumbing fixtures and associated faucets, valves, flushometer valves, and fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and associated faucets, valves, flushometer valves, and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224716 - PRESSURE WATER COOLERS

1.1 SUMMARY

A. Section Includes:

1. Pressure water coolers.
2. Bottle filling stations.
3. Supports.

1.2 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings:

1. Include diagrams for power wiring.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Pressure water coolers and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. Comply with ASHRAE 34 for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
3. Comply with UL 399.
4. Comply with ASME A112.19.3/CSA B45.4.
5. 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.
6. Comply with NSF 42 and NSF 53 for water filters for water coolers and bottle filling stations.
7. Comply with ICC A117.1 for accessible water coolers and bottle filling stations.

2.2 PRESSURE WATER COOLERS

A. Pressure Water Coolers - Surface Wall-Mounted, wheelchair accessible.

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. Elkay.
    b. Halsey Taylor.
    c. Oasis International.
2. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
3. Control: Push bar.
4. Glass filler.
5. Bottle Filler: Sensor activation automatic shutoff timer:
6. Drain: Grid with NPS 1-1/4 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters with capacity sized for unit peak flow rate.
10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
11. Support: Water-cooler carrier.
12. Water-Cooler Mounting Height: High/low - standard/accessible in accordance with ICC A117.1.
13. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics:
        1) Volts: 120 V ac.
        2) Phase: Single.
        3) Hertz: 60 Hz.

2.3 SUPPORTS

A. Water-Cooler Carrier:
    1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set freestanding, pressure water coolers on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers, and bottle filling stations to mounting frames.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.2 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.3 ELECTRICAL CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplates to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplates to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

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

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

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

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

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

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

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
2. Letter and Background Color: As indicated for specific application under Part 3.
3. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

B. Letter and Background Color: As indicated for specific application under Part 3.

C. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

F. Fasteners: Stainless steel rivets or self-taping screws.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA70E.

I. Label Content: Include caution and warning information plus emergency notification instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of mechanical equipment.

B. Sign and Label Colors:

1. White letters on an ANSI Z535.1 safety-blue background.

C. Locate equipment labels where accessible and visible.

D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

3.4 INSTALLATION OF DUCT LABELS

A. Install self-adhesive duct labels showing service and flow direction with permanent adhesive on air ducts.

1. Provide labels in the following color codes:

    a. For air supply ducts: White letters on blue background
    b. For air return ducts: White letters on blue background
    c. For exhaust-, outside-, relief-, return-, and mixed-air ducts: White letters on blue background

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.3 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by AABC NEBB or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Duct systems are complete with terminals installed.
b. Volume, smoke, and fire dampers are open and functional.
c. Clean filters are installed.
d. Fans are operating, free of vibration, and rotating in correct direction.
e. Variable-frequency controllers' startup is complete and safeties are verified.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
1. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.

2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.6 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.7 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.
    e. Filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Cooling-coil static-pressure differential in inches wg.

h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.

d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

I. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.8 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.

B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

F. Prepare test and inspection reports.

END OF SECTION

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply, return, outdoor air, oven and warewash exhaust, and general exhaust.

B. Related Sections:

1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

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

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

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

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

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

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
    b. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
    c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

    a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    c. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

    a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

2.8 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

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

E. Insulation Installation at Floor Penetrations:

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

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

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

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

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

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, supply, return, outdoor air, oven and warewash exhaust ducts, and general exhaust ducts.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.

6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply-Air and Return-Air Duct Insulation: Mineral-fiber liner, 1 inches thick and 1.5-lb/cu. ft. nominal density.

B. Supply-Air and Return-Air Duct in Unconditioned Space, Additional Insulation: Mineral-fiber wrap, 2 inches thick and 1.5-lb/cu. ft. nominal density, with FSK jacket.

C. Outdoor-Air Duct in Conditioned Spaces, Including Plenums, Insulation: Mineral-fiber wrap, 2 inches thick and 1.5-lb/cu. ft. nominal density. This same treatment applies to the portions of exhaust ducts between isolation / backdraft dampers and outlets open to the outdoors.

D. Oven and Warewash Exhaust-Air Duct: Mineral-fiber wrap, 2 inches thick and 1.5-lb/cu. ft. nominal density, with FSK jacket.

E. General Exhaust-Air Duct in Unconditioned Spaces Insulation: Mineral-fiber wrap, 2 inches thick and 1.5-lb/cu. ft. nominal density, with FSK jacket.

END OF SECTION

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Refrigerant piping

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

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

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Mineral-Fiber, Preformed Pipe Insulation:

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. Johns Manville; a Berkshire Hathaway company.
b. Manson Insulation Inc.
c. Owens Corning.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

F. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I for tubular materials, Type II, for sheet materials.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

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. Ramco Insulation, Inc.

2.3 ADHESIVES

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

B. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
2. Wet Flash Point: Below 0 deg F.
3. Service Temperature Range: 40 to 200 deg F.
4. Color: Black.

D. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

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. Johns Manville; a Berkshire Hathaway company.
b. P.I.C. Plastics, Inc.
c. Speedline Corporation.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.

4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

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. Childers Brand; H. B. Fuller Construction Products.

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

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. P.I.C. Plastics, Inc.
    c. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.8 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches.
2. Thickness: 6 mils.
3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with

insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.4 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
   2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.6 FINISHES

A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Flexible elastomeric, 1 inch thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric, 1 inch thick.

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

1. PVC: 20 mils thick.

3.10 OUTDOOR ABOVE GROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation is the following:

a. Flexible Elastomeric: 2 inches thick.

B. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. PVC: 30 mils thick.
2. Aluminum, Smooth: 0.024 inch thick.

END OF SECTION

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.0 SECTION INCLUDES

1.1 BUILDING AUTOMATION SYSTEM - GENERAL DESCRIPTION

1.2 APPROVED CONTROL SYSTEM MANUFACTURES

1.3 QUALITY ASSURANCE

1.4 CODES AND STANDARDS

1.5 SYSTEM PERFORMANCE

1.6 SUBMITTAL REQUIREMENTS

1.7 WARRANTY REQUIREMENTS

1.8 SYSTEM MAINTENANCE AND REMOTE ANALYSIS

1.9 OWNERSHIP OF PROPRIETARY MATERIAL

1.10 DEFINITIONS

1.1 BUILDING AUTOMATION SYSTEM - GENERAL DESCRIPTION

A. Provide a new Building Automation System (BAS) to integrate and control all mechanical equipment associated with this project.

1. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer’s factory as specified in those sections. The intent of the BAS is to integrate all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer’s responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency.

2. The BAS shall meet open standard protocol communication standards (As defined in System Communications Section) to ensure the system maintains “interoperability” to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects.

3. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of mechanical systems and terminal devices on this project.

4. Approved vendors, products and web services shall comply with SOC2 Type I as defined by the AICPA. SOC2 Type 1 compliance is a certification that confirms that a service provider has established and implemented effective controls to secure their clients' data in accordance with the Trust Services Criteria (TSC).

a. SOC2 Type 1 compliance provides assurance to customers that the service provider has established and implemented effective security controls and is committed to protecting their data.

b. To achieve SOC2 Type 1 compliance, the manufacturer shall have completed an independent audit to assess design and implementation of their controls, policies, and procedures.

5. The BAS shall accommodate simultaneous multiple user operation. Access to the control system data should be limited only by the security permissions of the operator role. Multiple users shall have access to all valid system data. An operator shall be able to log onto any workstation on the control system and have access to all appropriate data.

1.2 DDC SYSTEM MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Automated Logic Corporation.

2. Honeywell International Inc.

3. Johnson Controls, Inc.

1.3 QUALITY ASSURANCE

A. BAS Manufacturer Qualifications

1. The BAS manufacturer shall have an established business office within 50.00 miles of the project site and must provide 24 hours/day, 7 days/week response in the event of a customer warranty or service call.

2. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.

3. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, Web-based hardware/software, Open Standard Protocol hardware/software, Custom application Programming Language, Graphical Programming Language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.

4. Independent representatives of BAS manufacturers are not acceptable. BAS vendor must be corporate owned entity of BAS manufacturer.

1.4 CODES AND STANDARDS

A. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.

1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.

2. National Electrical Code -- NFPA 70.

3. Federal Communications Commission -- Part J.

4. ASHRAE/ANSI 135-2012 (BACnet) - (System Level Devices) - Building Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.

5. ASHRAE/ANSI 135-2012 (BACnet) - (Unit Level Devices) - Unit Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.

1.5 SYSTEM PERFORMANCE

A. Performance Standards. The BAS system shall conform to the following:

1. Graphic Display. The system shall display a graphic with a minimum of 20 dynamic points. All current data shall be displayed within 10 seconds of the operator's request.

2. Graphic Refresh. The system shall update all dynamic points with current data within 10 seconds.

3. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be 5 seconds. Analog objects shall start to adjust within 5 seconds.

4. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current within the prior 10 seconds.

5. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 10 seconds.

6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

7. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every 5 seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

8. Multiple Alarm Annunciations. All workstations on the network shall receive alarms within 5 seconds of each other.

1.6 SUBMITTAL REQUIREMENTS

B. BAS manufacturer shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software being provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.

1. Provide three (3) printed copies of submittal package for review and approval.

C. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the BAS manufacturer of furnishing quantities required based upon contract documents.

D. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with the specifications or which is deemed valuable in documenting and understanding the system to be installed.

E. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats once they have been approved and as-built drawings have been completed.

F. Submit the following within 90 days of contract award:

1. A complete bill of materials of equipment to be used indicating quantities, manufacturers and model numbers.

2. A schedule of all control valves including the valve size, pressure drop, model number (including pattern and connections), flow, CV, body pressure rating, and location.

3. A schedule of all control dampers including damper size, pressure drop, manufacturer, and model number.

4. Provide all manufacturers' technical cut sheets for major system components. When technical cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include:

a. Building Controllers

b. Custom Application Controllers

c. Application Specific Controllers

d. Operator Workstations

e. Portable Operator Terminals

f. Auxiliary Control Devices

5. Provide proposed Building Automation System architectural diagram depicting various controller types, workstations, device locations, addresses, and communication cable requirements

6. Provide detailed termination drawings showing all required field and factory terminations, as well as terminal tie-ins to DDC controls provided by mechanical equipment manufacturers. Terminal numbers shall be clearly labeled.

7. Provide a sequence of operation for each controlled mechanical system and terminal end devices.

8. Provide a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet system level device (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building systems if applicable for this project.

G. Project Record Documents: Upon completion of installation, submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:

1. Project Record Drawings - These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .dwg and .pdf drawing files shall be provided.

2. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.

3. Operating and Maintenance (O & M) Manuals - These shall be as-built versions of the submittal product data. In addition to the information required for the submittals, Operating & Maintenance manual shall include:

a. Procedures for operating the BAS including logging on/off, alarm management, generation of reports, trends, overrides of computer control, modification of setpoints, and other interactive system requirements.

b. Explanation of how to design and install new points, new DDC controllers, and other BAS hardware.

c. Documentation, installation, and maintenance information for all third party hardware/software products provided including personal computers, printers, hubs, sensors, valves, etc.

d. Original issue media for all software provided, including operating systems, programming language, operator workstation software, and graphics software.

e. Licenses, Guarantee, and Warranty documents for all equipment and systems.

H. Training Manuals: The BAS manufacturer shall provide a course outline and copies of training manuals at least two weeks prior to the start of any corporate training class to be attended by the Owner.

1.6 WARRANTY REQUIREMENTS

A. Warrant all work as follows:

1. BAS system labor and materials shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. BAS failures during the warranty period shall be adjusted, repaired, or replaced at no charge to the Owner. The BAS manufacturer shall respond to the Owner's request for warranty service within 24 hours of the initiated call and will occur during normal business hours (8AM-5PM).

2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the BAS is operational, and has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of the warranty period.

3. To ensure that the owner will have the most current operating system provided by the manufacturer, the BAS manufacturer shall include licensing and labor costs to facilitate software/firmware updates throughout the warranty period at no charge to the owner. These updates shall include upgrades for functional enhancements associated with the following: operator workstation software, project specific software, graphics, database, firmware updates, and all security related service packs. Written authorization by the Owner must be granted prior to the installation of these updates.

4. The BAS manufacturer shall provide a web-accessible Users Network for the proposed System and give the Owner free access to question/answer forum, user tips, upgrades, and training schedules for a one year period of time correlating with the warranty period.

1.7 SYSTEM MAINTENANCE AND REMOTE ANALYSIS

A. The BAS Manufacture shall provide Building Automation System remote support and system analysis for a period of 1 year (beginning the date of substantial completion).

B. The BAS manufacturer shall setup a secure remote connection for data collection, analytics and remote technical support for the HVAC systems included in this contract.

1. Provide technician support during the warranty period to diagnose issues remotely through the secure remote connection.

2. The building owner is responsible for providing adequate internet access.

C. Connectivity / Remote Access / Network Security

1. Provide and maintain secure remote access to the facilities Building Automation System (BAS) or other building systems. Users accessing service through this connection shall not have access to the building owners network. Secure remote access to the BAS shall not require ANY inbound ports on a firewall to be “exposed” or “forwarded”.

2. Secure remote access to the BAS shall be available anywhere, anytime, using a compatible client device (PC/tablet/phone)

3. The Owner will provide up to Three (3) IP drops and IP addresses on the owners network to gain access to the internet. The BAS manufacture shall coordinate with the Owners IT team, verify the proposed system shall meet all network security requirements and any other network configuration information necessary to each control contractor for the purpose of configuring each Area Controller on the network. It shall be the responsibility of the BAS manufacture to coordinate with the owner for network connectivity.

D. The BAS Manufacture shall provide a professional analysis for the facility HVAC systems.

1. The analysis shall consist of an evaluation of HVAC systems including charts and graphs which indicate both current building performance and opportunities for building and HVAC system performance improvement.

E. The following shall be provided after substantial completion of the project:

1. Orientation meeting with the building owner’s representative to identify the HVAC systems that will be evaluated.

2. System setup for data collection and analytics. BAS Manufacture to setup a secure remote data collection and analytics for identified systems.

3. Assessment analysis shall be performed by trained personnel with relevant professional credentials in HVAC systems, energy management and building optimization methodologies.

4. Consultation meeting with owner to review performance reports and improvement opportunities.

F. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of owner.

1.8 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project specific software and documentation shall become the owner’s property upon project completion. This includes the following:

1. Operator Graphic files

2. As-built hardware design drawings

3. Operating & Maintenance Manuals

4. BAS System software database

1.9 DEFINITIONS

A. DDC: Direct digital control

B. I/O: Input/output.

C. MS/TP: Manager Subordinate / Token Passing.

D. POT: Portable Operator's Terminal.

E. PID: Proportional plus integral plus derivative.

F. RTD: Resistance temperature detector.

G. BAS/ATC: Building Automation System/Automatic Temperature Controls.

PART 2 PRODUCTS

2.0 SECTION INCLUDES

2.1 MATERIALS:

2.2 SYSTEM COMMUNICATION

2.3 OPERATOR INTERFACE

2.4 BUILDING CONTROLLER SOFTWARE

2.5 BUILDING / SYSTEM CONTROLLERS

2.6 ADVANCED APPLICATION CONTROLLERS

2.7 APPLICATION SPECIFIC CONTROLLERS:

2.8 APPLICATION CONTROLLER for Packaged Rooftop Units

2.9 INPUT/OUTPUT INTERFACE:

2.10 POWER SUPPLIES:

2.11 AUXILLARY CONTROL DEVICES:

2.12 WIRING AND RACEWAYS:

2.1 MATERIALS:

A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Do not use this installation as a product test site unless explicitly approved in writing by the owner or the owner's representative. Spare parts shall be available for at least five years after completion of this contract.

2.2 SYSTEM COMMUNICATION

A. System Communications

1. Each workstation, building controller, and equipment controller communication interface shall utilize the BACnet™ protocol with an Ethernet (IEEE 802.3), Wi-Fi (IEEE 802.11), RS485 (EIA-485), or Zigbee® (802.15.4) physical interface and an appropriate data link technology as defined in ANSI®/ASHRAE® Standard 135-2012. (e.g. BACnet over IP, BACnet over IPv6, BACnet SC, BACnet over MS/TP, BACnet Zigbee).

2. All system controllers shall be BTL listed as a BACnet Building Controller (B-BC) as defined in ANSI®/ASHRAE® Standard 135-2012.

3. All documented status and control points, schedule, alarm, and data-log services or objects shall be available as standard object types as defined in ANSI®/ASHRAE® Standard 135-2012.

4. Each System Controller shall communicate with a network of Custom Application and Application Specific Controllers utilizing one or more of the interfaces documented within Field Bus Communications below.

5. All Operator Workstations (B-OWS, B-AWS) and Building Controllers (B-BC) shall support BACnet Secure Connect (BACnet SC), a secure and encrypted datalink layer specifically designed for those networks.

B. Field Bus Communications

1. BACnet™

a. All equipment and plant controllers shall be BTL listed as a BACnet Application Specific Controller (B-ASC) or a BACnet Advanced Application Controller (B-AAC) as defined in ANSI®/ASHRAE® Standard 135-2012.

b. All communication shall conform to ANSI®/ASHRAE® Standard 135-2012.

c. System Controller shall function as a BACnet router to each unit controller providing a globally unique BACnet Device ID for all BACnet controllers within the system.

d. BACnet Zigbee®

1) Communication between System Controller and equipment/plant controllers shall utilize BACnet Zigbee as defined in ANSI®/ASHRAE® Standard 135-2012.

2) Each equipment controller wireless communication interface shall self-heal to maintain operation in the event of network communication failure.

3) Each zone sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications. Sensing options shall include temperature, relative humidity, CO2, and occupancy.

e. BACnet MS/TP

1) Communication between System Controller and equipment/plant controllers shall utilize BACnet MS/TP as defined in ANSI®/ASHRAE® Standard 135-2012.

2.3 OPERATOR INTERFACE

A. Provide Building Operator Web Interface

1. Manufacturer shall provide a user interface with time-of-day schedules, data collection, dashboards, reports and building summary, system applications, and self-expiring timed overrides. Manufacturer shall provide a published user and applications guide(s) that detail the system application operation, configuration, setup and troubleshooting.

2. The building operator web interface shall be accessible via a web browser without requiring any “plug-ins” (i.e. JAVA Runtime Environment (JRE), Adobe Flash).

3. User Roles

a. The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.

b. User logon/logoff attempts shall be recorded.

c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.

4. On-Line Help and Training

a. Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.

b. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.

5. Equipment and Application Pages

a. The building operator web interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:

1) Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:

a) Each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These graphics shall show all points dynamically as specified in the points list.

b) Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.

2) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.

3) Historical Data (As defined in Trend Logs section of CONTROLLER SOFTWARE) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.

6. System Graphics. Building operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building area included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.

a. Graphic imagery – graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.

b. Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.

c. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

7. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.

8. Manual Control and Override

a. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.

b. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.

c. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.

d. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.

9. Scheduling. - The scheduling application shall provide graphical representation of the day, week, month and exception events.

10. Alarm/Event Notification

a. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any building operator web interface.

1) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.

2) The operator shall be able to acknowledge and add comments to alarms

3) Alarm/event messages shall use full language, easily recognized descriptors.

b. Alarm Suppression. Alarms shall be able to be suppressed based on load/source relationships to present the likely root cause to the building operator as described in ASHRAE Guideline 36. Load/Source relationships shall be configurable by the user through a web interface.

11. Reports and Logs.

a. The building operator web interface shall provide a reporting package that allows the operator to select reports.

b. The building operator web interface shall provide the ability to schedule reports to run at specified intervals of time.

c. The following standard reports shall be available without requiring a user to manually configure the report:

1) All Points in Alarm Report: Provide an on demand report showing all current alarms.

2) All Points in Override Report: Provide an on demand report showing all overrides in effect.

3) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.

4) Points report: Provide a report that lists the current value of all points

d. The controls vendor shall provide a hardening report that summarizes the port configuration details to ensure sites have not been exposed to the Internet in alignment with Cyber Security best practices.

B. Provide Mobile App Interface

1. Provide mobile (smart phone or tablet) interfaces to the building automation system, compatible with iOS and Android™ operating systems.

2. Controls manufacturer shall provide a phone/tablet interface with the ability to view/override status and setpoints, view/change schedules, view/acknowledge/comment on alarms, and view graphics for all spaces and equipment.

3. This phone/tablet interface shall resize itself appropriately for the size of the interface (i.e. no "pinching and zooming" required).

4. This phone/tablet interface shall function remotely from the facility while following IT security best practices (e.g. no ports exposed to the internet).

5. The operator interface shall support system access on a mobile device via a mobile app to:

a. Alarm log

b. System Status

c. Equipment status

d. Space Status

e. Standard Equipment graphics

f. Override set points

g. Override occupancy

h. Acknowledge Alarms

i. Add Comment(s) to Alarms

2.4 BUILDING CONTROLLER SOFTWARE

A. Manufacturer shall provide standard applications to deliver HVAC system control. Standard applications include Time of Day Scheduling with Optimal Start/Stop, VAV Air Systems Control, Chiller Plant Control, Historical Trend Logs and Trim and Respond. Manufacturer shall provide system optimization strategies for functions such as fan pressure optimization and ventilation optimization.

B. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the building operator interface.

1. Trend Logs

a. The system shall harvest trend logs for defined key measurements for each controlled HVAC device and HVAC application. Trend logs shall be captured for a minimum of 5 key operating points for each piece of HVAC equipment and HVAC application and stored for no less than 1 year at 15-minute intervals. Data Logs shall be capable of being configured on an interval or change of value basis.

1) Fan Coil

a) Discharge Air Temperature

b) Space Temperature Active

c) Space Temperature Setpoint Active

d) Air Flow Setpoint Active

e) Discharge Air Flow

2) Air Handling Unit/Rooftop (CV)

a) Discharge Air Temperature

b) Space Temperature Active

c) Space Temperature Setpoint Active

d) Cooling Capacity Status

e) Heating Capacity Primary Status

f) Outdoor Air Damper Position

2.5 BUILDING / SYSTEM CONTROLLERS

A. There shall be one or more independent, standalone microprocessor based System Controllers to manage the global strategies described in CONTROLLER SOFTWARE section.

1. The controller shall provide a USB communications port for connection to a PC.

2. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

3. All System Controllers shall have a real time clock and shall be able to accept a BACnet time synchronization command for automatic time synchronization.

4. Data shall be shared between networked System Controllers.

5. Serviceability – The System Controller shall have a display on the main board that indicates the current operating mode of the controller.

B. Controls manufacturer shall provide secure remote access to the Building Automation System (BAS). Secure remote access shall not require IP ports to be "exposed" (i.e. port-forwarded or external public IP addresses) to the Internet. Controls manufacturer shall update secure remote access software as necessary to follow cyber security best practices and respond to cyber security events.

2.6 ADVANCED APPLICATION CONTROLLERS

A. Advance Application Controllers shall be used to control all equipment or applications of medium and high complexity, including but not limited to Air Handlers, Boiler Plants and Chiller Plants.

B. The Advanced Application Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).

C. When the Advanced Application Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:

1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).

2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.

3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.

4. In case of communications failure, stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

D. For Stand-Alone Operation of Advanced Application Controllers:

1. Shall operate a schedule in a standalone application using a Real Time Clock with a 7 day power backup.

a. The Controller shall have a built in schedule (assessable with or without a display)

b. Support will be for at least 3 schedules with up to 10 events for each day of the week.

c. Each of the 3 schedules can be Analog, Binary or Multi-State

d. The controller shall support a minimum of 25 exceptions each with up to 10 events.

E. For ease of troubleshooting, the Controller shall support BACnet data trend logging.

1. With a minimum of 20,000 trending points total on a controller.

2. Trends shall be capable of being collected at a minimum sample rate of once every second

3. Shall be capable of trending all BACnet points used by controller

4. Trends shall be capable of being scheduled or triggered.

F. To meet the sequence of operation for each application, the Controller shall use library programs provided by the controller manufacturer that are either factory loaded or downloaded with service tool to the Controller.

G. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

1. Operating conditions:

a. Temperature: -40°F to 158°F (-40°C to 70°C)

b. Relative Humidity: 5% to 100% RH (non-condensing)

2. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.

3. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° F to 158° F [-40° C to 70° C].

H. Input/Output: The Controller shall have on board or through expansion module all I/O capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment. In addition other controls must meet the following requirements:

1. Shall support flexibility in valve type, the controllers shall be capable of supporting the following valve control types: 0-10VDC, 0-5VDC, 4-20mA, 24VAC - 2 position.

2. Shall support flexibility in sensor type, the Controller shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, 50ms or longer pulses, 200 to 20Kohm and RTD input.

3. Shall support flexibility in sensor type, all Analog Outputs shall have the additional capability of being programmed to operate as Universal Inputs or Pulse Width Modulation Outputs.

4. Shall support flexibility in sensor type, the Controller and/or expansion modules shall support dry and wetted (24VAC) binary inputs.

5. The controller shall support pulse accumulator for connecting devices like energy meters.

6. In order to support a wide range of devices, the Controller's binary output shall be able to drive at least 10VA each.

7. For future needs, any unused I/O that is not needed for the functionality of the equipment shall be available to be used by custom programs on the Controller and by any other controller on the network.

8. The Controller shall provide 24VAC and 24VDC power terminals sensors and other devices required.

9. The Controller shall provide a dedicated static pressure input.

I. Input/Output Expandability – The Controller shall provide the following functionality in order to meet current and future application needs:

1. For the application flexibility, the Controller shall be capable of expanding to a total of at least 100 hardware I/O terminations.

2. Expansion I/O can be mounted up to 650 ft. (200m) from control.

3. For optimized system operation, expansion I/O must communicate via an internal controller communication bus (point expansion via the BACnet MS/TP network is not allowed).

J. Serviceability – The Controller shall provide the following in order to improve serviceability of the Controller.

1. Diagnostic LEDs for power/normal operation/status, BACnet communications, sensor bus communications, and binary outputs. All wiring connections shall be clearly labeled and made to be field removable.

2. Binary and analog inputs and outputs shall use removable connectors or be connected to terminal strip external to the control box.

3. Software service tool connection through the following methods: direct cable connection to the Controller, connection through another controller on BACnet link

4. For safety purposes, the controller shall be capable of being powered by a portable computer's USB port for the purposes of configuration, programming and testing programs so that this work can be accomplished with the power off to the associated equipment.

5. The Controller software tool service port shall utilize standard off-the-shelf USB printer cable.

6. Capabilities to temporarily override the BACnet point values with built-in time expiration in the Controller.

7. To aid in service replacement, the Controller shall easily attached to standard DIN rail mounting.

8. For future expansion, the Controller shall be capable of adding sequence of operation programming utilizing service tools software with a graphical programming interface (editing or programming in line code is not permissible).

9. To aid in service replacement, the Controller shall allow for setting its BACnet address via controller mounted rotary switches that correspond to the numerical value of the address. (DIP switch methodologies are not allowed). Setting of the address shall be accomplished without the need of a service tool or power applied to the controller.

10. Controller data shall be maintained through a power failure.

K. Software Retention: All Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.

L. Controller must meet the following Agency Compliance:

1. UL916 PAZX, Open Energy Management Equipment

2. UL94-5V, Flammability

3. FCC Part 15, Subpart B, Class B Limit

4. BACnet Testing Laboratory (BTL) listed as BACnet Advanced Application Controller (B-AAC)

2.7 APPLICATION SPECIFIC CONTROLLERS:

A. General Description

1. Application Specific Controllers (ASC) shall be microprocessor-based DDC controllers which, through hardware or firmware design, control specified equipment. They are not user programmable, but are customized for operation within the confines of the equipment they are designed to serve.

2. Zone Controllers are controllers that operate equipment that control the space temperature of single zone. Examples are controllers for VAV, Fan coil, Blower Coils, Unit Ventilators, Heat Pumps, and Water Source Heat Pumps.

B. The Application Specific Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).

C. When the Application Specific Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:

1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).

2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.

3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.

4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

D. Stand-Alone Operation: Each piece of equipment specified in section “A” shall be controlled by a single controller and provide stand-alone control in the event that a BAS is not present.

E. Software

1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.

2. For controlling ancillary devices and for flexibility to change the sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.

F. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.

1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.

2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.

3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.

4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].

G. Input/Output:

1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).

2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, pulse counts, and 200 to 20Kohm.

3. For flexibility in selection and replacement of binary devices, the controller shall support dry and wetted (24VAC) binary inputs.

4. For flexibility in selection and replacement devices, the controller’s shall have binary output which are able to drive at least 12VA each.

5. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).

6. For future needs, any I/O that is unused by functionality of equipment control shall be available to be used by custom program on the controller and by another controller on the network.

7. For future expansion and flexibility, the controller shall have either on board or through expansion, 20 hardware input/output points. Expansion points must communicate with the controller via an internal communications bus. Expansion points must be capable of being mounted up to 650ft. (200 m) from the controller. Expansion points that require the BACnet network for communication with the controller are not allowed.

H. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.

1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.

2. All binary output shall have LED's indicating the output state.

3. All wiring connectors shall removable without the use of a tool.

4. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link

5. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.

6. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.

7. BACnet MAC Address shall be set using decimal (0-9) based rotary switches.

a. Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.

8. For ease of troubleshooting, the Controller shall support BACnet data trend logging.

a. With a minimum of 20,000 trending points total on controller

b. Trends shall be capable of being collected at a minimum sample rate of once every second.

c. Shall be capable of trending all BACnet points used by controller

d. Trends shall be capable of being scheduled or triggered

I. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.

J. Application controller shall meet the following Agency Compliance:

1. UL916 PAZX, Open Energy Management Equipment

2. UL94-5V, Flammability

3. FCC Part 15, Subpart B, Class B Limit

4. BACnet Testing Laboratory (BTL) listed as BACnet Application Specific Controller (B-ASC)

2.8 APPLICATION CONTROLLER for Packaged Rooftop Units

A. The Rooftop Unit (RTU) Application Controller shall be a microprocessor-based DDC controller which, through hardware or firmware design, controls specified equipment. The controller is not user programmable, but is customized for operation within the confines of the equipment it is designed to serve.

B. The Application Controller shall be capable of operating as a stand-alone controller or as a member of a Building Automation System (BAS).

C. When the Application Controller is operating as a member of a Building Automation System (BAS), the application controller shall operate as follows:

1. Application Controller will receive operation mode commands from the BAS network controller. The BAS commands shall include but not be limited to the follow: Occupied Heat/Cool, Unoccupied Heat/Cool, Morning Warm-up, / Pre-cool, Occupied Bypass).

2. Application Controller will provide equipment status parameters to the BAS through BACnet communication.

3. Application Controller will operate as a stand-alone controller in the event of communication failure with the BAS.

4. In case of communications failure stand-alone operation shall use default values or last known values for remote sensors read over the network such as outdoor air temperature.

D. Software

1. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or customized with use of service tool native to the controller.

E. Environment: Controller hardware shall be suitable for the anticipated ambient conditions.

1. Storage: -55° to 203° F (-48° to 95° C) and 5 to 95% Rh, non-condensing.

2. Operating: -40° to 158° F (-40 to 70° C) and 5 to 95% Rh, non-condensing.

3. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum.

4. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40° to 158° F [-40° to 70° C].

F. Controller Input/Output: The controller shall have on board capable of performing all functionality needed for the application. Controls provided by the equipment manufacture must supply the required I/O for the equipment.

1. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following output types; 0-10VDC, 0-5VDC, 4-20mA, Binary.

2. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, Pulse counts, and 200 to 20Kohm.

G. Serviceability – The controller shall provide the following in order to improve serviceability of the controller.

1. Diagnostic LEDs shall indicate correct operation or failures/faults for all of the following: power, sensors, BACnet communications, and I/O communications bus.

2. All binary output shall have LED’s indicating the output state.

3. All wiring connectors shall removable without the use of a tool.

4. Software service tool connection through the following methods: direct cable connection to the controller, connection through another controller on BACnet link.

H. Software Retention: All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.

I. Controller shall meet the following Agency Compliance:

1. UL916 PAZX, Open Energy Management Equipment
2. UL94-5V, Flammability
3. FCC Part 15, Subpart B, Class B Limit
4. BACnet Testing Laboratory (BTL) listed

2.9 INPUT/OUTPUT INTERFACE:

A. Hardwired inputs and outputs may tie into the system through building, custom application, or ASCs.

B. All input points and output points shall be protected such that shorting of the point to itself, to another point, or to ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against the effects of contact bounce and noise. Binary inputs shall sense “dry contact” closure without external power (other than that provided by the controller) being applied.

D. Pulse accumulation input objects. This type of object shall conform to all the requirements of binary input objects and also accept up to 10 pulses per second for pulse accumulation.

E. Analog inputs shall allow the monitoring of low voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

F. Binary outputs shall provide for on/off operation or a pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers shall have status lights. Outputs shall be selectable for either normally open or normally closed operation.

G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0 to 10VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.

H. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms shall run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

I. System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The operator interfaces installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.10 POWER SUPPLIES:

A. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish overcurrent protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.

a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration.

b. Line voltage units shall be UL recognized and CSA approved.

2.11 AUXILLARY CONTROL DEVICES:

A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:

1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.

2. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.

3. Damper shaft bearings shall be as recommended by manufacturer for application.

4. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.

5. All leakage testing and pressure ratings will be based on AMCA Publication 500.

6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.

B. Control dampers shall be parallel or opposed blade types as scheduled on drawings.

C. Electric damper/valve actuators

1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.

3. All rotary spring return actuators shall be capable of both clockwise or counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.

4. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.

5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.

6. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.

7. Actuators shall be Underwriters Laboratories Standard 873 listed.

8. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.

D. Control Valves

1. Control valves shall be two-way or three-way type for two-position or modulating service as scheduled or shown.

2. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:

a. Water Valves:

1) Two-way: 150% of total system (pump) head.

2) Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

b. Steam Valves: 150% of operating (inlet) pressure.

E. Binary Temperature Devices

1. Low-voltage space thermostat shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

2. Line-voltage space thermostat shall be bimetal-actuated, open contact type, or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 13°C to 30°C (55°F to 85°F) setpoint range, 1°C (2°F) maximum differential, and vented ABS plastic cover.

3. Low-limit thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type, with an element of 6 m (20 ft) minimum length. Element shall respond to the lowest temperature sensed by any 30 cm (1 ft) section. The low-limit thermostat shall be manual reset only.

F. Wired Temperature Sensors

1. Temperature sensors shall be RTD or thermistor.

2. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 1.5 m (5 ft) in length per 1 m2 (10 ft2) of duct cross section.

3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe.

4. Space sensors shall be equipped with setpoint adjustment, override switch, display, and/or communication port as shown on plans.

5. Provide matched temperature sensors for differential temperature measurement.

G. Wired Humidity Sensors

1. Duct and room sensors shall have a sensing range of 20% to 80%.

2. Duct sensors shall be provided with a sampling chamber.

H. Static Pressure Sensors

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.

2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.

3. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.

4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

I. Low Limit Thermostats

1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section.

2. Low limit shall be manual reset only.

2.12 WIRING AND RACEWAYS:

A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of this specification.

B. All insulated wire to be copper conductors, UL labeled for 90°C (194°F) minimum service.

C. Fiber Optic Cable. Optical cables shall be duplex 900 mm tight-buffer construction designed for intra-building environments. The sheath shall be UL Listed OFNP in accordance with NEC Article 770. The optical fiber shall meet the requirements of FDDI, ANSI X3T9.5 PMD for 62.5/125 µm.

PART 3 EXECUTION

3.0 SECTION INCLUDES

3.1 EXAMINATION:

3.2 PROTECTION:

3.3 COORDINATION:

3.4 GENERAL WORKMANSHIP:

3.5 FIELD QUALITY CONTROL:

3.6 COMMUNICATION WIRING:

3.7 FIBER OPTIC CABLE:

3.8 INSTALLATION OF SENSORS:

3.9 FLOW SWITCH INSTALLATION:

3.10 WARNING LABELS:

3.11 IDENTIFICATION OF HARDWARE AND WIRING:

3.12 CONTROLLERS:

3.13 PROGRAMMING:

3.14 CONTROL SYSTEM CHECKOUT AND TESTING:

3.15 CLEANING:

3.16 TRAINING:

3.1 EXAMINATION:

A. The Contract Documents shall be thoroughly examined for coordination of control devices, their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Architect/Engineer for resolution before rough-in work is started.

B. The BAS manufacturer shall inspect the jobsite in order to verify that control equipment can be installed as required, and any dis¬crepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.2 PROTECTION:

A. The BAS installation contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage thus caused.

B. The BAS manufacturer shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.3 COORDINATION:

A. Site

1. Where the mechanical work will be installed in close proximity to, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, so as to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition without extra charge.

2. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.

B. Submittals. Refer to the “Submittals,” section of this specification for requirements.

C. Test and Balance

1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.

2. The contractor shall provide training in the use of these tools. This training will be planned for a duration of 4 hours.

3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.

4. The tools used during the test and balance process shall be returned to the contractor at the completion of the testing and balancing.

D. Life Safety

1. Duct smoke detectors required for air handler shutdown shall be supplied under Section 26100 of this specification. The contractor shall interlock smoke detectors to air handlers for shutdown as described in the Sequences of Operation for this project.

2. Smoke dampers and actuators required for duct smoke isolation are provided under Section 26100. The contractor shall interlock these dampers to the air handlers as described in the Sequences of Operation for this project as applicable.

3. Fire/smoke dampers and actuators required for fire rated walls are provided under another Section 26100. Control of these dampers shall be by 26100

E. Coordination with Controls Specified in Other Sections or Divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the contractor as follows:

1. All communication media and equipment shall be provided as specified in the “Communication” section of this specification.

2. Each supplier of a controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.

3. The Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.

3.4 GENERAL WORKMANSHIP:

A. Install equipment, piping, wiring/conduit, parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible locations as defined by National Electric Code (NEC). Control panels shall be attached to structural walls or properly supported in a free-standing configuration, unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.

D. Verify integrity of all control wiring to ensure continuity and freedom from shorts and grounds prior to commencing the startup and commissioning procedures.

E. All control device installation and wiring shall comply with Contract Documents, acceptable industry specifications, and industry standards for performance, reliability, and compatibility. Installation and wiring shall be executed in strict adherence to local codes and standard practices referenced in Contract Documents.

3.5 FIELD QUALITY CONTROL:

A. All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Contract Documents.

B. BAS manufacturer shall continually monitor the field installation for building code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.

C. BAS installing Contractor(s) shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.6 COMMUNICATION WIRING:

A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

B. Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer shall not be exceeded during installation.

D. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each particular cable.

E. When a cable enters or exits a building, a lighting arrestor must be installed between the line and ground.

F. All runs of communication wiring shall be unspliced length when the length is commercially available.

G. All communication wiring shall be labeled to indicate origin and destination.

3.7 FIBER OPTIC CABLE:

A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacturer's specifications.

C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.8 INSTALLATION OF SENSORS:

A. Sensors required for mechanical equipment operation shall be factory installed and wired as specified in mechanical equipment specifications. BAS manufacturer shall be responsible for coordinating these control devices and ensuring the sequence of operations will be met. Installation and wiring shall be in accordance with the BAS manufacturer's recommendations.

B. Sensors that require field mounting shall meet the BAS manufacturer's recommendations and be coordinated with the mechanical equipment they will be associated.

C. Mount sensors rigidly and adequately for the environment the sensor will operate.

D. Room temperature sensors shall be installed on concealed junction boxes properly supported by the block wall framing. For installation in dry wall ceilings, the low voltage sensor wiring can be installed exposed and must meet applicable National and Local Electrical Codes.

E. All wires attached to wall mounted sensors shall be sealed off to prevent air from transmitting in the associated conduit and affecting the room sensor readings.

F. Install duct static pressure tap with tube end facing directly down-stream of air flow.

G. Install space static pressure sensor with static sensing probe applicable for space installation where applicable.

H. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.

I. All pipe mounted temperature sensors shall be installed in matched thermowells. Install all liquid temperature sensors with heat conducting fluid in thermal wells for adequate thermal conductance.

J. Wiring for space sensors shall be concealed in building drywall. EMT conduit is acceptable within mechanical equipment and service rooms.

K. Install outdoor air temperature sensors on north wall complete with sun shield at manufacturer's recommended location and coordinated with Engineer.

3.9 FLOW SWITCH INSTALLATION:

A. Coordinate installation of flow switch with Mechanical Contractor who will be responsible for installing a thread o let in steel piping applications. Copper pipe applications will require the use CxCxF Tee, and no pipe extensions or substitutions will be allowed.

B. Mount a minimum of 5 pipe diameters upstream and 5 pipe diameters downstream, or two feet, whichever is greater, from pipe fittings and other inline potential obstructions.

C. Install in accordance with manufacturers' instructions, which will require proper flow direction, horizontal alignment with flow switch mounting on the top of pipe.

3.10 WARNING LABELS:

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the BAS system.

B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

3.11 IDENTIFICATION OF HARDWARE AND WIRING:

A. All field wiring and cabling, including that within factory mounted, and wired control panels and devices for mechanical equipment, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information for troubleshooting, maintenance, and service purposes. BAS manufacturer to coordinate this labeling requirement with mechanical equipment manufacturer as it relates to controls.

B. Permanently label or code each point of field terminal strips to show the instrument or item served and correlate them to the BAS design drawings.

C. Identify control panels with minimum 1-cm letters on laminated plastic nameplates.

D. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.12 CONTROLLERS:

A. Provide a separate DDC Controller for individual HVAC mechanical equipment. BAS manufacturer shall furnish and coordinate DDC controllers and control devices and ensure that installation and wiring adhere to BAS manufacturer's design recommendations. For those mechanical equipment units that do not have factory installed controls specified, the BAS manufacturer shall field mount

controls and coordinate all installation and termination information to ensure the specified sequence of operations are met.

B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type (analog or digital) found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used in each controller.

1. Future use of spare I/O point capacity shall require providing the field instrument and control device, field wiring, engineering, programming, and commissioning. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.13 PROGRAMMING:

A. Provide sufficient internal memory for all controllers to ensure specified sequence of operations, alarming, trending, and reporting requirements are achieved. BAS manufacturer shall provide a minimum of 25% spare memory capacity for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

C. Software Programming

1. Provide programming for individual mechanical systems to achieve all aspects of the sequence of operation specified. It is the BAS manufacturer's responsibility to ensure all mechanical equipment functions and operates as specified in sequence of operations. Provide sufficient programming comments in controller application software to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

D. BAS Operator's Interface

1. When Operator Workstation is specified, provide color graphics for each piece of mechanical equipment depicting sufficient I/O to monitor and troubleshoot operation. Operator color graphics shall include Air Handling Units, Rooftop Units, Fan Coil Units, Unit Ventilators, Exhaust Fans, etc. These standard graphics shall depict all points dynamically as specified in the points list and/or indicated in sequence of operation.

2. The BAS manufacturer shall provide all the labor necessary to install, initialize, start up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any third party software installation and integration required for successful operation of the operator interface.

3. As part of this execution phase, the BAS manufacturer shall perform a complete test of the operator interface.

3.14 CONTROL SYSTEM CHECKOUT AND TESTING:

A. Start-up testing. All testing in this section shall be performed by the contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the owner's representative is notified of the system demonstration.

1. The contractor shall furnish all labor and test apparatus required to calibrate and prepare for service all of the instruments, controls, and accessory equipment furnished under this specification.

2. Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

3. Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures according to manufacturer's recommendations.

4. Verify all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starter, etc.) operate properly and normal positions are correct.

5. Verify all analog output devices (I/Ps, actuators, etc) are functional, that start span are correct, and that direction and normal positions are correct. The contractor shall check all control valves and autoatic dampers to ensure proper action and closure. The contractor shall make any necessary adjustments to valve stem and damper blade travel.

6. Verify the system operation adheres to the sequences of operation. Simulate and observe all modes of operation by overriding and varying inputs and schedules. Tune all DDC loops and optimal start/stop routimes.

7. Alarms and Interlocks

a. Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

b. Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

c. Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

3.15 CLEANING:

A. The BAS manufacturer's installing contractor(s) shall clean up all debris resulting from their installation activities on a daily basis. The installation contractors shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Owner, Construction Manager, General Contractor, and/or Mechanical Contractor.

B. At the completion of work in any area, the installation contractor shall clean all of their work, equipment, etc., making it free from dust, dirt and debris.

C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage. Any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.16 TRAINING:

A. Provide minimum of (4) hours of operator training throughout the contract period. The training will be provided for personnel designated by the Owner.

B. These objectives will be divided into logical groupings; participants may attend one or more of these, depending on level of knowledge required:

1. Day-to-day BAS Operators

2. BAS Troubleshooting & Maintenance

SECTION 230923.12 - CONTROL DAMPERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular control dampers with airfoil blades.
2. Electric and electronic control-damper actuators.

B. Related Requirements:

1. Section 230923 "Direct Digital Control (DDC) System for HVAC" for control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of damper and actuator:

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE 62.1 Compliance: Applicable outdoor ventilation requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. Code Compliance: Comply with governing energy code.

E. Ground Fault: Properly ground products to prevent failing due to ground fault conditions.

F. Backup Power Source: Serve control-damper actuators from a backup power source where associated with systems and equipment served by a backup power source.

G. Environmental Conditions: For actuators not available with integral enclosures complying with requirements indicated, house in protective secondary enclosures complying with requirements.

2.2 RECTANGULAR CONTROL DAMPERS WITH AIRFOIL BLADES

A. General Requirements:

1. Factory assemble multiple damper sections to provide a single damper assembly of size required by the application.

a. Include multisection damper assemblies with intermediate reinforcing where required between individual sections being joined together. Construct reinforcing of same material (aluminum, galvanized steel, stainless steel) as damper frame.

B. Rectangular Control Dampers with Aluminum Airfoil Blades and Frames:

1. Construction:

a. Frame:

1) Material: ASTM B211/B211M, Alloy 6063 T5 extruded-aluminum profiles, minimum 0.125 inch thick.
2) Arrangement: Hat-shaped channel with integral extended face flange(s) having mating face of minimum 1 inch for attachment to duct flanges, plenum walls, and equipment.
3) Width: Not less than 5 inches.

b. Blades:

1) Configuration: Parallel or opposed blade configuration as required by application.
2) Material: ASTM B211/B211M, Alloy 6063 T5 extruded-aluminum profiles, 0.07 inch thick.
3) Shape: Hollow, airfoil.
4) Length: As required by close-off pressure rating, not to exceed 48 inches.
5) Width: Not to exceed 6 inches.

c. Seals:

1) Blades: Replaceable; extruded Santoprene, silicone, or damper manufacturer-offered equivalent, as required by performance requirements. Seals are mechanically attached in extruded blade slots.
2) Jambs: Replaceable; stainless steel, compression type or mechanically attached extruded silicone.

d. Axles:

1) Diameter: Minimum 0.375 inch.
2) Material: Aluminum.
3) Mechanically attached to blades.

e. Bearings:

1) Material: Molded stainless steel sleeve, as required by operating conditions, mounted in frame.
2) Where blade axles are installed in vertical position, provide thrust bearings.

f. Linkage:

1) Hardware: Plated steel.
2) Material: Aluminum.
3) Mounting: Concealed in frame.

g. Transitions with Sleeve:

1) For round and flat oval duct applications, provide damper assembly with integral transitions to mate to adjoining field connections.
2) Factory mount damper in a sleeve with a close transition to mate to field connection.

a) Sleeve length not less than 12 inches for dampers without jackshafts and not less than 16 inches for dampers with jackshafts.
b) Oversize damper and sleeve for duct connection size plus minimum 4 inches.

3) Fabricate sleeve and transitions of materials (aluminum, galvanized steel or stainless steel) to match damper frame or adjoining duct.
4) Match end connections (flange or sleeve) to field connections.

2.3 GENERAL CONTROL-DAMPER ACTUATORS REQUIREMENTS

A. Select actuators to operate related damper(s) with sufficient reserve power to provide smooth modulating action or two-position action and proper speed of response at velocity and pressure conditions to which the damper is subjected.

B. Select actuators with sufficient power and torque to close off against the maximum system pressures encountered. Actuators are to be sized to close off against the fan shutoff pressure as a minimum requirement.

C. The total damper area operated by an actuator is not to exceed 80 percent of manufacturer's maximum area rating.

D. Provide one actuator for each damper assembly where possible. Operate multiple actuators required to drive a single damper assembly in unison.

E. Avoid the use of excessively oversized actuators, which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.

F. Use jackshafts and shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.

G. Provide mounting hardware and linkages for connecting actuator to damper.

H. Select actuators to fail in desired position in the event of a power failure.

2.4 ELECTRIC AND ELECTRONIC CONTROL-DAMPER ACTUATORS

A. Type: Motor operated, with or without gears, electric and electronic.

B. Voltage:

1. See Drawings.
2. Actuator to deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.
3. Actuator to function properly within a range of 85 to 120 percent of nameplate voltage.

C. Construction:

1. Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed-steel enclosures.
2. 100 up to 400 W: Gears ground steel, oil immersed, shaft-hardened steel running in bronze, copper alloy, or ball bearings. Operator and gear trains are to be totally enclosed in dustproof cast-iron, cast-steel, or cast-aluminum housing.
3. Greater Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

D. Local Field Adjustment: Make spring-return actuators easily switchable from fail-safe open to fail-safe closed in the field without replacement.

E. Local Manual Override: Provide gear-type actuators with an external manual adjustment mechanism to allow manual positioning of the damper when the actuator is not powered.

F. Two-Position Actuators: Single direction, spring return or reversing type.

G. Modulating Actuators:

1. Capable of stopping at all points across full range, and starting in either direction from any point in range.
2. Control Input Signal:

    a. Three Point, Tristate, or Floating Point: Clockwise and counter-clockwise inputs. One input drives actuator to open position, and other input drives actuator to close position. No signal of either input remains in last position.
    b. Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for 0 to 10 or 2 to 10 V dc and 4 to 20 mA signals.
    c. Pulse Width Modulation (PWM): Actuator drives to a specified position according to a pulse duration (length) of signal from a dry-contact closure, triac sink, or source controller.
    d. Programmable Multifunction:

        1) Control input, position feedback, and running time are to be factory or field programmable.
        2) Diagnostic feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
        3) Service data, including at a minimum, number of hours powered and number of hours in motion.

H. Position Feedback:

1. Equip two-position actuators with limit switches or other positive means of a position indication signal for remote monitoring of open and close position.
2. Equip modulating actuators with a position feedback through current or voltage signal for remote monitoring.
3. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.

I. Fail-Safe:

1. Where indicated, provide actuator to fail to an end position.
2. Internal spring-return mechanism to drive controlled device to an end position (open or close) on loss of power.
3. Batteries, capacitors, and other nonmechanical forms of fail-safe operation are acceptable only where uniquely indicated.

J. Integral Overload Protection:

1. Provide against overload throughout the entire operating range in both directions.
2. Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.

K. Damper Attachment:

1. Unless otherwise required for damper interface, provide actuator designed to be directly coupled to damper shaft without need for connecting linkages.

2. Attach actuator to damper drive shaft in a way that ensures maximum transfer of power and torque without slippage.
3. Bolt and setscrew method of attachment is acceptable only if provided with at least two points of attachment.

L. Temperature and Humidity:

1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F.
2. Humidity: Suitable for humidity range encountered by application; minimum operating range is to be from 5 to 95 percent relative humidity, noncondensing.

M. Enclosure:

1. Suitable for ambient conditions encountered by application.
2. Provide actuator enclosure with a heater and controller where required by application.

N. Stroke Time:

1. Select operating stroke time to be compatible with equipment and system operation.
2. For actuators operating in smoke-control and other life-safety systems, comply with governing code and NFPA requirements.

PART 3 - EXECUTION

3.1 CONTROL-DAMPER APPLICATIONS

A. Select from damper types indicated to achieve performance requirements and characteristics indicated while subjected to full range of system operation encountered.

3.2 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Properly support dampers and actuators, tubing, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a seismic, wind, or others forces common to the application.

C. Provide ceiling, floor, roof, and wall openings, and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

D. Seal penetrations made in fire-rated and acoustically rated assemblies.

E. Fastening Hardware:

1. Wrenches, pliers, or other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

F. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.3 CONTROL DAMPERS

A. Install smooth transitions, not exceeding 15 degrees, to dampers larger or smaller than adjacent duct. Install transitions as close to damper as possible but at distance to avoid interference and impact to performance. Consult manufacturer for recommended clearance.

B. Clearance:

1. Locate dampers for easy access and provide separate support of dampers that cannot be handled by service personnel without hoisting mechanism.
2. Install dampers with at least 24 inches of clear space on sides of dampers requiring service access unless more space is recommended by manufacturer. Provide code required clearances as applicable.

C. Service Access:

1. Install dampers and actuators to be accessible for visual inspection and service.
2. Install access door(s) in duct or equipment located upstream of damper to allow service personnel to hand clean any portion of damper, linkage, and actuator. Comply with requirements in Section 233300 "Air Duct Accessories."

D. Install dampers straight and true, level in all planes, and square in all dimensions.

E. Install supplementary structural reinforcement for large multiple-section dampers if factory-furnished support alone cannot handle loading.

F. Attach field-installed actuator(s) to damper drive shaft.

G. For duct-mounted and equipment-mounted dampers installed outside of equipment, install a visible and accessible indication of damper position from outside.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing is to have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with damper identification on damper.

3.5 ELECTRICAL CONNECTIONS

A. Install electrical power to field-mounted control devices requiring electrical power.

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260523 "Control-Voltage Electrical Power Cables."

C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

D. Furnish and install raceways. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems."

E. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

F. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.6 CONTROL CONNECTIONS

A. Install control signal wiring to field-mounted control devices.

B. Connect control signal wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

C. Furnish and install raceways. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems."

3.7 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed surfaces.

3.8 STARTUP

A. Control-Damper Checkout:

1. Check installed products before continuity tests, leak tests, and calibration.
2. Check dampers for proper location and accessibility.
3. Verify that control dampers are installed correctly for flow direction.
4. Verify that proper blade alignment, either parallel or opposed, has been provided.
5. Verify that damper frame attachment is properly secured and sealed.
6. Verify that damper actuator and damper linkage attachment are secure.
7. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
8. Verify that damper blade travel is smooth and unobstructed throughout operating range.

3.9 ADJUSTMENT, CALIBRATION, AND TESTING:

A. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

B. Check and document open and close cycle times for applications with a cycle time of less than [**30**] <**Insert value**> seconds.

C. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B 584.

2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

C. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Electrically Operated Valves: Comply with UL 429.

1. Pilot operated.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
6. NEMA ICS 6, Type 4, coil enclosure.
7. Normally closed.
8. Visual position indicator.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.

10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 2 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 2 psig.

2.7 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Replace pipe having damaged PE coating with new pipe.

D. Install fittings for changes in direction and branch connections.

E. Piping on roof shall be painted safety yellow.

F. Piping on exterior building walls shall be painted to match building.

3.2 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Verify final equipment locations for roughing-in.

K. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

L. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

    1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

M. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

N. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

O. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

P. Connect branch piping from top or side of horizontal piping.

Q. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

R. Do not use natural-gas piping as grounding electrode.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.11 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground: Bronze plug valves.

3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.

1.2 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

1. Submit data for each type of refrigerant piping, fitting, valve, piping specialty, and refrigerant.

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding, Brazing, and Fusing Qualifications."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASHRAE 15.

B. Comply with ASME B31.5.

C. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B280, Type ACR.

B. Wrought-Copper Fittings, Solder Joint: ASME B16.22.

C. Wrought-Copper Fittings, Brazed Joint: ASME B16.50.

D. Wrought-Copper Unions: ASME B16.22.

E. Solder Filler Metals: ASTM B32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

F. Brazing Filler Metals: AWS A5.8M/A5.8.

G. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping in accordance with ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves in accordance with Section 230553 "Identification for HVAC Piping and Equipment."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.2 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints in accordance with AWS BRH, "Brazing Handbook," Ch. 35, "Pipe and Tubing."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and to restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 ft. long.
2. Roller hangers and spring hangers for individual horizontal runs 20 ft. or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 ft. or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System must maintain test pressure at the manifold gauge throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

C. Prepare test and inspection reports.

3.5 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.6 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, in accordance with manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves but not bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealant and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Factory- and shop-fabricated ducts and fittings.
2. Fittings.
3. Reinforcement and spacing.
4. Seam and joint construction.
5. Penetrations through fire-rated and other partitions.
6. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Linx Industries (formerly Lindab).

    b. McGill AirFlow LLC.

    c. SEMCO LLC.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 or G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.

3. Outdoor, Return-Air Ducts: Seal Class A.
4. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.
5. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
6. Conditioned Space, Exhaust Ducts: Seal Class A.
7. Conditioned Space, Return-Air Ducts: Seal Class A.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12 .

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Galvanized.

E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Turning vanes.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

B. Related Requirements:

1. Section 283111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Nailor Industries Inc.
3. Vent Products Co., Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 1-inch wg.

E. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Felt.

I. Blade Axles:

1. Material: Nonferrous metal.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Aluminum.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Screen Mounting: Rear mounted.
4. Screen Material: Aluminum.
5. Screen Type: Insect.
6. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

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. Flexmaster U.S.A., Inc.
    b. McGill AirFlow LLC.
    c. Nailor Industries Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Nonferrous metal.
7. Bearings:

    a. Molded synthetic.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. McGill AirFlow LLC.
2. Nailor Industries Inc.
3. Vent Products Co., Inc.

B. Frames:

1. Hat shaped.
2. 0.094-inch-thick, galvanized sheet steel.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Parallel-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin.

5. Blade Edging: Closed-cell neoprene.

D. Blade Axles: 1/2-inch-diameter; nonferrous metal; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS, FIRE/SMOKE DAMPERS, AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Nailor Industries Inc.
3. Vent Products Co., Inc.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Fire Dampers

1. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

K. Smoke Dampers and Combination Fire/Smoke Dampers

1. Provide smoke dampers and combination fire/smoke dampers as shown on the Drawings and where architectural drawings indicate smoke/fire rated partitions.
2. Smoke dampers and combination fire/smoke dampers and actuators shall meet the requirements of NFPA 92A and NFPA 92B and shall be labeled as a "Leakage Rated Damper for Use in Smoke Control Systems" in accordance with latest edition of UL 555S. Smoke dampers shall be of low leakage design qualified to UL 555S leakage Class I and shall have a UL 555S elevated temperature rating of 350 degrees F minimum.
3. Supply each smoke damper and combination fire/smoke damper with a factory mounted damper actuator. Combination fire/smoke dampers shall be manufactured with a metal sleeve of appropriate length and thickness for the required damper installation, and the damper actuator shall be installed on the sleeve exterior. Damper actuators shall be pneumatic unless otherwise indicated. Dampers shall fail to the closed position.
4. Damper Frame: Galvanized steel formed into a structural hat channel shape with reinforced corners. The blades shall be airfoil type. Bearings shall be sintered bronze sleeve turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber designed to withstand 250 degrees F and jamb seals shall be stainless steel flexible metal compression type with silicone rubber backing, Class I rated.
5. Each combination fire/smoke damper shall also be equipped with a temperature limited re-openable feature as required by Code to meet the smoke control sequence of operation.

2.7 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Ward Industries; a brand of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Ward Industries; a brand of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Ward Industries; a brand of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.10 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries; a brand of Hart & Cooley, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

D. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.11 DUCT ACCESSORY HARDWARE

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

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
2. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with draw bands.

P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION

SECTION 233346 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flexible duct connectors.

1.2 ACTION SUBMITTALS

A. Product data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A and NFPA 90B.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials must be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with the Air Duct Council's (formerly, Air Diffusion Council) "ADC Flexible Air Duct Test Code - FD 72-R1" and "Flexible Duct Performance & Installation Standards."

D. Comply with ASTM E96/E96M.

2.2 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless steel band with stainless steel or zinc-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

B. Non-Clamp Connectors: Adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION OF FLEXIBLE DUCTS

A. Install flexible ducts in accordance with applicable details in the following publications:

1. ADC's "Flexible Duct Performance & Installation Standards" for flexible ducts.
2. NAIMA AH116.
3. SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
4. SMACNA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. Install in indoor applications only. Do not install flexible duct in locations where it will be exposed to UV lighting.

C. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

D. Connect diffusers and light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

E. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting must not exceed a minimum of one-duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.
6. Install in accordance with ADC instructions.

F. Supporting Flexible Ducts:

1. Support flexible duct at manufacturer's recommended intervals, but at no greater distance than 4 ft.. Provide sufficient support so that maximum centerline sag is 1/2 in. per ft. between supports. A connection to rigid duct or equipment may be considered a support joint.
2. Install extra supports at bends placed approximately one-duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports must not exceed the maximum spacing in accordance with manufacturer's written installation instructions.
4. Vertically installed ducts must be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line centrifugal fans.

2. Centrifugal Ventilators – Sidewall

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Loren Cook Company.
2. Greenheck

3. Soler and Palau.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Companion Flanges: For inlet and outlet duct connections.

F. Capacities and Characteristics:

1. Wheel Type: Backward inclined.
2. Electrical Characteristics:

a. Volts: 120.
b. Phase: Single.
c. Hertz: 60.

3. Vibration Isolators:

a. Type: Elastomeric hangers.
b. Static Deflection: 1 inch.

2.2 CENTRIFUGAL VENTILATORS - SIDEWALL

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. JencoFan.
2. Loren Cook Company.
3. PennBarry; division of Air System Components.

B. Configuration: Centrifugal sidewall ventilator.

C. Housing: Removable spun aluminum; square, one-piece aluminum base with venturi inlet cone.

D. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings; minimum ABMA9,.
4. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
5. Motor Pulleys: Adjustable pitch for use with motors through **5** hp.
   Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions. Provide fixed pitch for use with motors larger than **5** hp.
6. Fan and motor isolated from exhaust airstream.

E. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside outside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
5. Spark-resistant, all-aluminum wheel construction.
6. Mounting Pedestal: Galvanized steel with removable access panel.
7. Wall Mount Adapter: Attach wall-mounted fan to wall.
8. Grease Hood Kitchen Exhaust: UL 762 listed for grease-laden air exhaust.

2.3 MOTORS

1. Electrically Commutated Motors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch.

B. Install units with clearances for service and maintenance.

C. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
5. Disable automatic temperature-control operators, energize motor and adjust fan to indicated CFM, and measure and record motor voltage and amperage.

6. Shut unit down and reconnect automatic temperature-control operators.
7. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

END OF SECTION

SECTION 23 37 13.13
AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rectangular and square ceiling diffusers.
   2. Louver face diffusers.

B. Related Requirements:
   1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
   2. Section 23 37 13.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Nailor Industries Inc.
   2. Price Industries.
   3. Titus.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel.

D. Finish: Baked enamel, white.

E. Face Size: 24 by 24 inches.

F. Face Style: Plaque.

G. Pattern: Fixed.

H. Dampers: Butterfly.

I. Accessories:
   1. Equalizing grid.
   2. Plaster ring.
   3. Sectorizing baffles.

2.2 LOUVER FACE DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. Nailor Industries Inc.
   2. Price Industries.
   3. Titus.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel.

D. Finish: Baked enamel, white.

E. Pattern: Adjustable core style.

F. Dampers: Opposed blade.

G. Accessories:
   1. Square to round neck adaptor.
   2. Operating rod extension.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final

locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

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

END OF SECTION

SECTION 23 37 13.23
REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed face grilles.

B. Related Requirements:
   1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
   2. Section 23 37 13.13 "Air Diffusers" for various types of air diffusers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GRILLES

A. Fixed Face Grille:

   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. Nailor Industries Inc.
      b. Price Industries Limited.
      c. Titus; brand of Johnson Controls International plc, Global Products.

   2. Material: Steel.
   3. Finish: Baked enamel, white.
   4. Wall and Duct Face Blade Arrangement: Horizontal; spaced 3/4 inch apart.
   5. Ceiling Face Arrangement: Perforated core.
   6. Core Construction: Integral.
   7. Frame: 1-1/4 inches wide.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 233813 - COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Commercial-kitchen hoods, Type I.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Filters/baffles.
2. Fire-suppression systems.
3. Luminaires.

B. Shop Drawings:

1. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
2. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
3. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
4. Show control cabinets.
5. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
6. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
7. Include diagrams for power, signal, and control wiring.
8. Duct Connections: Detail connections between ducts and hoods, including access doors and panels.
9. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.

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 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A666, Type 430.

1. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.

    a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.

2. Concealed Stainless-Steel Surfaces: ASTM A480/A480M, No. 2B finish (bright, cold-rolled, unpolished finish).
3. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Zinc-Coated Steel Shapes: ASTM A36/A36M, zinc coated according to ASTM A123/A123M requirements.

C. Sealant: ASTM C920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial-kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR 177.2600, for use in areas that come in contact with food.

1. Color: As selected by Architect from manufacturer's full range.
2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

D. Sound Dampening: NSF-certified, non-absorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.

E. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.3 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.

1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.

5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A780/A780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets unless otherwise indicated.

J. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

K. Fabricate enclosure panels to ceiling and wall as follows:

1. Fabricate panels on all exposed side(s) with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
2. Wall Offset Spacer: Minimum of 3 inches.
3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," with minimum 0.0625-inch-thick, stainless-steel shelf tops.

2.4 EXHAUST HOOD FABRICATION, TYPE I HOOD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Accurex.
2. CaptiveAire Systems.
3. Larkin.

B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.

1. Fabricate hoods according to NSF 2, "Food Equipment."
2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
3. Duct Collars: Minimum 0.0598-inch-thick steel at least 3 inches long, continuously welded to top of hood and at corners.

C. Hood Configuration: Exhaust only.

D. Hood Style: Wall-mounted canopy.

E. Filters/Baffles: Removable, stainless-steel. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Safety for Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.

F. Luminaires: Recessed, LED fixtures and lamps with lenses sealed vapor tight. Wiring shall be in conduit on hood exterior. Number and location of luminaires shall provide a minimum of 70 fc at 30 inches above finished floor.

1. Light switches shall be mounted on front panel of hood canopy.
2. Luminaires: LED complying with UL 1598.

G. Hood Controls: Wall-mounting control cabinet, fabricated of stainless steel.

1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with makeup air supply fan to operate simultaneously. Interlock exhaust fan with fire-suppression system to operate fan(s) during fire-suppression-agent release and to remain in operation until manually stopped. Include red pilot light to indicate fan operation.
2. High-Temperature Control: Alarm shall sound and cooking equipment shall shut down before hood discharge temperature rises to actuation temperature of fire-suppression system.

2.5 FIRE-SUPPRESSION SYSTEM, WET CHEMICAL

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ansul; brand of Johnson Controls International plc, Building Solutions North America.
2. Kidde; Carrier Global Corporation.
3. Pyro-Chem; brand of Johnson Controls International plc, Building Solutions North America.

B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.

1. Steel Pipe, NPS 2 and Smaller: ASTM A53/A53M, Type S, Grade A, Schedule 40, plain ends.
2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
5. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
6. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
7. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate

fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Coordinate equipment layout and installation with adjacent Work, including luminaires, HVAC equipment, plumbing, and fire-suppression system components.

B. Complete field assembly of hoods where required.

1. Make closed butt and contact joints that do not require filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "General Hood Fabrication Requirements" Article.

C. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

D. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.

E. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners unless otherwise indicated.

F. Install hoods to operate free from vibration.

G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

J. Set initial temperatures, and calibrate sensors.

K. Set field-adjustable switches.

L. Connect ducts according to requirements in Section 233300 "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquidtight joint.

M. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Perform hood performance tests required by authorities having jurisdiction.
4. Perform fire-suppression system performance tests required by authorities having jurisdiction.

B. Commercial-kitchen hoods will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 235123 - GAS VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Listed double-wall vents.

B. Related Requirements:

1. Section 235113.16 "Vent Dampers" for motorized and barometric dampers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2 - PRODUCTS

2.1 LISTED TYPE B AND BW VENTS

A. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

C. Inner Shell: ASTM B209, Type 1100 aluminum ASTM B209, Type 3003 aluminum ASTM B209, Type 3105 aluminum ASTM A666, Type 430 stainless steel.

D. Outer Jacket: Galvanized or Aluminized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
2. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.
3. Termination: Exit cone with drain section incorporated into riser.
4. Termination: Antibackdraft.

PART 3 - EXECUTION

3.1 APPLICATION

A. Listed Type B and BW Vents: Vents for certified gas appliances.

3.2 INSTALLATION OF LISTED VENTS

A. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Lap joints in direction of flow.

E. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION

SECTION 235416.13 - GAS-FIRED FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gas-fired furnaces, condensing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:

a. Furnace Heat Exchanger: 10 years.
b. Integrated Ignition and Blower Control Circuit Board: Five years.
c. Draft-Inducer Motor: Five years.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency, and marked for intended location and application.

B. General Requirements for Noncondensing Gas-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

2.2 GAS-FIRED FURNACES, CONDENSING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Carrier Global Corporation.
2. Lennox Industries, Inc.; Lennox International.
3. Trane.

B. Cabinet: Steel.

1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.

C. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

D. Type of Gas: Natural.

E. Heat Exchanger:

1. Primary: Stainless steel.
2. Secondary: Stainless steel.

F. Burner:

1. Gas Valve: 100 percent safety main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

G. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

H. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

I. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.

J. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall or roof.
2. PVC Plastic Vent Materials:

a. PVC Plastic Pipe: Schedule 40, complying with ASTM D1785.
b. PVC Plastic Fittings: Schedule 40, complying with ASTM D2466, socket type.
c. PVC Solvent Cement: ASTM D2564.

2.3 THERMOSTATS AND HUMIDISTATS

A. Controls shall comply with requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."

B. Solid-State, Combination Thermostat and Humidistat: Wall-mounted, programmable, microprocessor-based unit with automatic switching from heating to cooling and humidifying to dehumidifying, preferential rate control, seven-day programmability with minimum of four temperature presets per day,and battery backup protection against power failure for program settings.

2.4 AIR FILTERS

A. Disposable Filters: 1-inch-thick fiberglass media in sheet metal frame.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

D. Controls: Install thermostats and humidistats at mounting height of 60 inches above floor.

E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

3.2 PIPING CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Vent Connection, Noncondensing, Gas-Fired Furnaces: Connect Type B vents to furnace vent connection and extend outdoors. Type B vents and their installation requirements are specified in Section 235123 "Gas Vents."

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

    a. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. CPVC Piping: Join according to ASTM D2846/D2846M, Appendix.
    c. PVC Pressure Piping: Join schedule number ASTM D1785PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.

4. Slope pipe vent back to furnace or to outside terminal.

3.3 DUCTWORK CONNECTIONS

A. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233300 "Air Duct Accessories."

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and test for leaks. Repair leaks, replace lost refrigerant, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION

SECTION 235533.16 - GAS-FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gas-fired unit heaters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of gas-fired unit heater.

1. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings: For gas-fired unit heaters. Include plans, elevations, sections, and attachment details.

1. Prepare by or under the supervision of a qualified professional engineer detailing fabrication and assembly of gas-fired unit heaters, as well as procedures and diagrams.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Two 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.

2.2 GAS-FIRED UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Modine Manufacturing Company.
2. REZNOR, a brand of Nortek Global HVAC.
3. Trane.

B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

C. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Type of Venting: Indoor, separated combustion, power vented.

E. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.

F. Accessories:

1. Four-point suspension kit.
2. Power Venter: Centrifugal aluminized-steel fan, with stainless steel shaft; 120-V ac motor.
3. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.

G. Heat Exchanger: Aluminized steel.

H. Burner Material: Aluminized steel with stainless steel inserts Stainless steel.

I. Propeller Unit Fan:

1. Aluminum propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

J. Centrifugal Unit Fan:

1. Steel, centrifugal fan dynamically balanced and resiliently mounted.
2. Belt-Driven Drive Assembly:

a. Resiliently mounted to housing, with the following features:

1) Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2) Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

3) Pulleys: Cast-iron, adjustable-pitch motor pulley.

K. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."
2. Enclosure Materials: Rolled steel.

3. Efficiency: Premium efficient.

L. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

1. Gas Control Valve: Single stage.
2. Ignition: Electronically controlled electric spark with flame sensor.
3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
4. Control transformer.
5. High Limit: Thermal switch or fuse to stop burner.
6. Thermostat:

a. Mounting: Wall.
b. Single stage.
c. Fan on-off-automatic switch.
d. 24-V ac.
e. 50 to 90 deg F operating range.

M. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54 CSA B149.1, applicable local codes and regulations, and manufacturer's written instructions.

3.2 EQUIPMENT MOUNTING

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

B. Substrate-Mounted Units: Provide supports connected to substrate. Secure units to supports.

1. Spring hangers are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
2. Threaded Rods, Spring Hangers, and Building Attachments: Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" and Section 230548 "Vibration and Seismic Controls for HVAC."
3. Threaded Rods, Spring Hangers, Building Attachments, and Seismic Restraints: Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." and Section 230548 "Vibration and Seismic Controls for HVAC."
4. Anchor the unit to resist code-required horizontal acceleration.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.

C. Gas Piping: Comply with Section 231123 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

D. Vent Connections: Comply with Section 235123 "Gas Vents."

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

    a. Test procedures used.
    b. Test results that comply with requirements.
    c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Gas-fired unit heater will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

END OF SECTION

SECTION 23 72 23.29 - AIR-TO-AIR ENERGY RECOVERY VENTILATOR

PART 1 - GENERAL

1.1 SUMMARY

- This section includes Air-to-Air Energy Recovery Ventilators for rooftop installation.
- Within this document, these units may be referred to as Energy Recovery Ventilator (ERV) for brevity.

1.2 RELATED

Drawing and general provisions of the contract, including General Requirements Division 01, Division 23, Division 23 Specifications Sections, and common work requirements for HVAC apply to work specified in this section.

- Section 23 09 00: Controls and Instrumentation

1.3 SUBMITTALS

- Product data: For each type or model of Energy Recovery Ventilator, include the following:
    - Unit performance data for both Supply Air and Exhaust Air, with system operating conditions indicated.
    - Enthalpy plate performance data for both summer and winter operation.
    - Motor ratings and unit electrical characteristics.
    - Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
    - Estimated gross weight of each installed unit.
    - Filter types, quantities, and sizes
    - Installation, Operating and Maintenance manual (IOM) for each model.
- Shop Drawings: For air-to-air energy recovery ventilators, include plans, elevations, sections, details, and attachments to other work.
    - Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    - Wiring Diagrams: For power, signal, and control wiring.
- Operation and maintenance data for air-to-air energy recovery ventilator

1.4 QUALITY ASSURANCE

- Source Limitations: Obtain Air-to-Air Energy Recovery Ventilator with all appurtenant components or accessories from a single manufacturer.

- For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.
- The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten (10) years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two (2) years from the date of installation.
- Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
- Certifications:
    - The energy recovery cores used in these products shall be third party Certified by AHRI under its Standard 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacturer’s published performance for airflow, static pressure, temperature and total effectiveness, purge air (OACF) and exhaust air leakage (EATR). Products that are not currently AHRI certified will not be accepted. OACF shall be no more than 1.02 and EATR shall be at 0% against balanced airflow.
    - Entire unit shall be listed under UL 1812 Standard for Ducted Air to Air Heat Exchangers and comply with CSA Standard 22.2.
    - Units intended for outdoor use shall be rain tested in accordance with UL 1812 Section 67.
- Every unit to be factory tested prior to shipping: Motor Dielectric Voltage-Withstand Bench Test, Unit Dielectric Voltage-Withstand Test, Continuity of Internal Control Circuits Test, Unit Amperage Test

1.5 COORDINATION

- Coordinate size and location of all building penetrations required for installation of each Energy Recovery Ventilator and associated electrical systems.
- Coordinate sequencing of construction for associated plumbing, HVAC, electrical supply.
- Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:
    - RenewAire
    - Fantech
    - American Aldes Ventilation Coorporation

2.2 MANUFACTURED UNITS

- Air-to-Air Energy Recovery Ventilators shall be fully assembled at the factory and consist of a fixed-plate cross-flow heat exchanger with no moving parts, an insulated double wall G90 galvanized painted 20-gauge steel cabinet, outdoor air hood with bird screen, motorized outside air intake damper, filter assemblies for both intake and exhaust air, enthalpy core, supply air blower assembly, motorized return air damper, exhaust air hood, exhaust air blower assembly and electrical control box with all specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection. Entire unit with the exception of field-installed components shall be assembled and test operated at the factory.

2.3 CABINET

- Materials: Formeddouble wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
- Outside casing: 20 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish.
- Access doors shall be hinged with airtight closed cell foam gaskets. Door pressure taps, with captive plugs, shall be provided for cross-core pressure measurement allowing for accurate airflow measurement.
- Unit shall have factory-installed duct flanges on all duct openings.
- Cabinet Insulation: Unit walls and doors shall be insulated with 1 inch, 4 pound density, foil/scrim faced, high density fiberglass board insulation, providing a cleanable surface and eliminating the possibility of exposing the fresh air to glass fibers, and with a minimum R-value of 4.3 (hr-ft^2-°F/BTU).
- Enthalpy core: Energy recovery core shall be of the total enthalpy type, capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air. No condensate drains shall be allowed. The energy recovery core shall be designed and constructed to permit cleaning and removal for servicing. The energy recovery core shall have a ten year warranty. Performance criteria are to be as specified in AHRI Standard 1060.

- Control center / connections: Energy Recovery Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections to the non-fused disconnect.
- Passive Frost Control: The ERV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10ºF and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be allowed.
- Motorized Isolation Damper(s): Return Air and Outside Air motorized damper(s) of an AMCA Class I low leakage type shall be factory installed.

2.4 BLOWER SECTION

- Blower section construction, Supply Air and Exhaust Air: Blower assemblies consist of a TEFC motor, and a belt driven forward-curved blower.
- Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.

2.5 MOTORS

- Blower motors shall be Premium Efficiency, EISA compliant for energy efficiency. The blower motors shall be totally enclosed (TEFC) and be shall be supplied with factory installed motor starters.
- Belt drive motors shall be provided with adjustable pulleys and motor mounts allowing for blower speed adjustment, proper motor shaft orientation and proper belt tensioning.

2.6 UNIT CONTROLS

- Fan control: Motor starter and contactor
- Sensors: Dirty filter monitor for both airstreams.
- Factory-installed microprocessor controller and sensors, ERV controls that:
    - Comply with requirements in Division 23 Section "Sequence of Operations for HVAC Controls"
    - Has factory-installed hardware and software to enable the building automation interface via Modbus to monitor, control, and display status and alarms
    - The microprocessor controller shall be capable of operating at temperatures between -20F to 160F
    - The microprocessor controller shall be a DIN rail mounting type
    - Factory-installed microprocessor controller shall come with backlit display that allows menu-driven display for navigation and control of unit
    - The microprocessor controller shall have the ability to communicate with the BMS via Modbus RTU/TCP and BACnet MSTP/IP

- The microprocessor controller shall have integrated ethernet interface and a web server for displaying unit parameters
- The microprocessor shall have near field communication (NFC) capability for android devices
- The microprocessor controller shall have an internal programmable time clock that will allow the user to add up to different occupancy schedules and add holidays
- The microprocessor control shall be capable of integral diagnostics
- The microprocessor control shall be capable of IP or SI unit display
- The microprocessor controller shall have a battery powered clock
- The microprocessor controller shall at a minimum offer the ability for three modes of determining occupancy: a dry contact, the internal time clock or the BMS
- A remote user terminal to allow for remote monitoring and adjustment of parameters, allowing ease of control access without going outdoors or into the mechanical room if desired by the user
- The microprocessor controller shall have at a minimum (10) universal inputs/outputs (AI, DI, AO) and have (6) six relay outputs (DO)
- The microprocessor controller shall have an integrated fieldbus port
- The microprocessor controller shall have the capability for I/O expansion
- The microprocessor controller shall have a micro USB port to load the application program, the unit parameters, saving logs, etc.
- The sensors that will be required for control are:
    - (2) Temperature sensor for fresh air and exhaust air
    - (2) Temperature and humidity sensor for outside air, return air
    - (2) Differential pressure sensors for filter alarms
    - (2) Adjustable current switches
- The microprocessor controller shall have the capability to monitor the unit conditions for alarm conditions. Upon detecting an alarm, the microprocessor controller shall have the capability to record the alarm description, time, date, available temperatures, and unit status for user review. A digital output shall be reserved for remote alarm indication. Alarms to be also communicated via BMS as applicable. Provide the following alarm functions:
    - Outside air temperature sensor alarm
    - Outside air humidity sensor alarm
    - Return air temperature sensor alarm
    - Return air humidity sensor alarm
    - Fresh air sensor alarm
    - Exhaust air sensor alarm
    - Dirty filter alarm
    - Supply and exhaust air proving alarm
    - Outside airflow sensor alarm
    - Exhaust airflow sensor alarm

        - Airflow out of range alarm

    - Display the following on the face of microprocessor controller:
        - Unit on
        - Heating status
        - Outdoor air temperature
        - Outdoor air humidity
        - Return air temperature
        - Return air humidity
        - Supply air temperature
        - Airflows in both airstreams
        - Unit on/off
        - Fan on/off
        - Damper status
        - Alarm digital display
    - The microprocessor controller shall have factory pre-programmed multiple operating sequences for control of the ERV. Factory default settings shall be fully adjustable in the field. Available factory pre-programmed sequences on operations are:

2.7 FILTER SECTION

- ERV shall have 2" thick MERV 8 disposable pleated filters located in the outdoor air and exhaust airstreams. All filters shall be accessible from the exterior of the unit.

PART 3 – EXECUTION

3.1 EXAMINATION

- Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.
- Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.
- Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer’s installation instructions as documented in manufacturer’s IOM, Best Practices and all applicable building codes.
- Install unit with clearances for service and maintenance.

3.3 CONNECTIONS

In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

- Duct installation and connection requirements are specified in Division 23 of this document.
- Electrical installation requirements are specified in Division 26 of this document.

3.4 FIELD QUALITY CONTROL

- Contractor to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to Architect/Engineer in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM. Insert any other requirements here.

3.5 START-UP SERVICE

- Contractor to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6 DEMONSTRATION AND TRAINING

- Contractor to train owner's maintenance personnel to adjust, operate and maintain the entire Make-Up Air unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

SECTION 237416.11 - PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged, small-capacity, rooftop air-conditioning units (RTUs) with the following components and accessories:

1. Casings.
2. Fans.
3. Motors.
4. Coils.
5. Refrigerant circuit components.
6. Air filtration.
7. Gas furnaces.
8. Dampers.
9. Electrical power connections.
10. Controls.
11. Accessories.
12. Roof curbs.

1.2 ACTION SUBMITTALS

A. Product Data: For each RTU.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of RTUs that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. AHRI Compliance:

1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested according to AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

C. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.

D. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Performance:

1. Basic Wind Speed: 120 miles per hour.
2. Building Classification Category: III.
3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

2.3 CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Double-Wall Construction: Fill space between walls with 1-inch foam insulation and seal moisture tight for R-7 performance.

C. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1 inch.
3. Liner materials shall have airstream surface coated with erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

E. Condensate Drain Pans: Fabricated using stainless-steel sheet 0.025 inch thick, a minimum of 2 inches deep, and complying with ASHRAE 62.1 for design and construction of drain pans.

1. Drain Connections: Threaded nipple.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.4 FANS

A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

1. Direct-Driven Supply-Air Fans: Motor shall be resiliently mounted in the fan inlet.

2. Belt-Driven Supply-Air Fans: Motors shall be installed on an adjustable fan base resiliently mounted in the casing.

B. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECM motors.

C. Exhaust-Air Fan: shaft mounted on permanently lubricated motor.

2.5 MOTORS

A. Comply with Section 230513 "Common Motor Requirements for HVAC Equipment" and the requirements of this Article.

B. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

C. Efficiency: Premium efficient.

2.6 COILS

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Coil Split: Interlaced.
3. Coated.

B. Hot-gas-reheat Refrigerant Coil:

1. Aluminum-plate fin brazed to aluminum microchannel tube.
2. Capable of 20 deg. F temperature rise at all operating conditions, controlled to within plus or minus 2 deg. F.

2.7 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, variable-speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.

2.8 AIR FILTRATION

A. Minimum arrestance and MERV according to ASHRAE 52.2.

2.9 GAS FURNACE

A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

1. CSA Approval: Designed and certified by and bearing label of CSA.

B. Burners: Stainless steel.

1. Fuel: Natural gas.
2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.

C. Heat-Exchanger and Drain Pan: Stainless steel.

D. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.

E. Gas Valve Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.10 DAMPERS

A. Leakage Rate: Comply with ASHRAE/IES 90.1.

B. Damper Motor: Modulating with adjustable minimum position.

2.11 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.12 CONTROLS

A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2.13 ACCESSORIES

A. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer. Outlet shall be energized even if the unit main disconnect is open.

B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

C. Safeties:

1. Smoke detector.
2. Condensate overflow switch.
3. Phase-loss protection.
4. High and low pressure control.
5. Gas furnace airflow-proving switch.

D. Coil guards of painted, galvanized-steel wire.

E. Hail guards of galvanized steel, painted to match casing.

F. Door switches to disable heating or reset set point when open.

G. Outdoor-air intake weather hood with moisture eliminator.

H. Oil separator.

2.14 ROOF CURBS

A. 14 inch tall insulated structural roof curbs to provide support for the rooftop air-conditioning unit and provide a weather protected area for terminating and securing the roof membrane, of a design certified by a licensed structural engineer as compliant with ASCE 7.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Roof Curb: Install on roof structure, level and secure, according to AHRI Guideline B. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing with anchor bolts.

3.2 CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

C. Where installing piping adjacent to RTUs, allow space for service and maintenance.

1. Gas Piping: Comply with applicable requirements in Section 231123 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

D. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Install nameplate for each electrical connection indicating electrical equipment designation and circuit number feeding connection.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Prepare test and inspection reports.

3.4 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION

SECTION 237433 - DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dedicated outdoor air-handling units.

1.2 ACTION SUBMITTALS

A. Product Data: For each dedicated outdoor-air unit.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Warranty: Manufacturer agrees to replace components of dedicated outdoor-air units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Dedicated Outdoor-Air-Handling Units:

a. Five years entire unit parts from date of Substantial Completion.
b. Warranty Period for Compressors: Five years from date of Substantial Completion.
c. Warranty Period for Heat Exchangers: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DEDICATED OUTDOOR-AIR UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CaptiveAire
2. Trane
3. Daikin

B. Unit Casing:

1. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
2. Double-Wall Configuration:

a. Outside Casing Wall: Galvanized steel, minimum 20 gauge thick with manufacturer's standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
b. Roof: Standing seam or membrane; sloped to drain water.
c. Casing Insulation:

1) Materials: Polyurethane foam insulation.
2) Casing Panel R-Value: Minimum R-13.
3) Insulation Thickness: 2 inches.
4) Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roofs of air-handling unit.

3. Panels and Doors:

a. Panels:

1) Fabrication: Formed and reinforced double-wall and insulated panels of same materials and thicknesses as casing.
2) Fasteners: Two or more camlock-type fasteners for panel lift-out operation. Arrangement shall allow panels to be opened against airflow.
3) Gasket: Neoprene, applied around entire perimeters of panel frames.
4) Size: Large enough to allow unobstructed access for inspection and maintenance of unit's internal components.

b. Doors:

1) Fabrication: Formed and reinforced double-wall and insulated panels of same materials and thicknesses as casing.
2) Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever latches, operable from inside and outside. Arrange doors to be opened against airflow. Provide safety latch retainers on doors so that doors do not open uncontrollably.
3) Gasket: Neoprene, applied around entire perimeters of panel frames.
4) Size: Large enough to allow for unobstructed access for inspection and maintenance of air-handling unit's internal components.

4. Condensate Drain Pans:

a. Construction:
b. Size: Large enough to collect condensate from cooling coils, including coil piping connections, coil headers, and return bends.
c. Drain Connection:

1) Located on one end of pan, at lowest point of pan.
2) Terminated with threaded nipple.

d. Width: Entire width of water-producing device.

C. Fans, Drives, And Motors:

1. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
2. Supply-Air Fans and Relief-Air Fans: Centrifugal; galvanized or painted steel; mounted on solid-steel shaft.

a. Housings, Plenum Fans: Steel frame and panel; fabricated without fan scroll and volute housing. Provide inlet screens for Type SWSI fans.

b. Airfoil, Centrifugal Fan Wheels (Plenum Fan Wheels): Smooth-curved inlet flange, backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; steel hub riveted to backplate and fastened to shaft with setscrews.
c. Shaft Lubrication Lines: Extended to a location outside the casing.

3. Drive, Direct: Factory-mounted direct drive.
4. Condenser-Coil Fan: propeller, mounted on shaft of permanently lubricated electronically commutated motors.
5. Motors:

a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
b. Efficiency: Premium efficient as defined in NEMA MG 1.
c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
d. Mount unit-mounted disconnect switches on exterior of unit.

6. Variable-Frequency Motor Controller: Serving all fans combined in fan array.

a. Manufactured Units: Pulse-width modulated; for inverter-duty motors.
b. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

D. Coils:

1. General Requirements for Coils:

a. Comply with AHRI 410.
b. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
c. Coils are not to act as structural component of unit.

E. Refrigeration Circuit Components:

1. Compressors: Hermetic, variable-speed scroll compressors, mounted on integral vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.
2. Refrigerant: R-410A.

F. Air Filtration:

1. Panel Filters:

a. Description: Pleated factory-fabricated, self-supported disposable air filters with holding frames.
b. Filter Unit Class: UL 900.
c. Media: Interlaced glass, synthetic, or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
d. Filter-Media Frame: High wet-strength beverage board with perforated metal retainer, or metal grid, on outlet side.

G. Indirect-Fired Gas Furnace Heating:

1. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47 and with NFPA 54.
2. CSA Approval: Designed and certified by and bearing label of CSA.
3. Burners:

a. Heat-Exchanger Material: Stainless steel.
b. Fuel: Natural gas.
c. Ignition: Electronically controlled electric spark with flame sensor.
d. Gas Control Valve: Electronic modulating.
e. Gas Train: Single-body, regulated, redundant, 24 V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

4. Venting, Gravity: Gravity vented.
5. Heat-Exchanger Drain Pan: Stainless steel.
6. Safety Controls:

a. Gas Manifold: Safety switches and controls complying with ANSI standards.
b. High Limit: Thermal switch or fuse to stop burner.
c. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
d. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
e. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
f. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

H. Dampers:

1. Outdoor- and Relief-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1 inch wg and 8 cfm/sq. ft. at 4 inches wg.
2. Electronic Damper Operators:

a. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
b. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.
c. Power Requirements (Modulating): Maximum 10 VA at 24 V ac or 8 W at 24 V dc.
d. Temperature Rating: Minus 22 to plus 122 deg F.

I. Electrical Power Connections:

1. Single-Point Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a single-point field power connection to unit.

J. Controls:

1. Control Valves: Comply with requirements in Section 230923.11 "Control Valves."
2. Control Wiring: Factory wire connection for controls' power supply.
3. Control Devices: Sensors, transmitters, relays, switches, detectors, operators, actuators, and valves shall be manufacturer's standard items to accomplish indicated control functions.
4. Status Panel: Unit mounted.

a. Cooling/Off/Heating Controls: Control operational mode.
b. Damper Position: Indicate position of outdoor-air dampers in terms of percentage of outdoor air.

5. Refrigeration System Controls:

    a. Unit-mounted enthalpy controller shall lock out refrigerant system when outdoor-air enthalpy is less than 28 Btu/lb of dry air or outdoor-air temperature is less than 60 deg F.
    b. Outdoor-air sensor de-energizes dehumidifier operation when outdoor-air temperature is less than 60 deg F.
    c. Relative-humidity sensor energizes dehumidifier operation when relative humidity is more than 50 percent.

6. Furnace Controls:

    a. Factory-mounted sensor in supply outlet with sensor adjustment located in control panel to modulate gas furnace burner to maintain space temperature.
    b. Burner Control: Modulating.

7. Damper Controls: Space-pressure sensor modulates outdoor- and relief-air dampers to maintain a positive pressure in space at a minimum of 0.05 inch wg with respect to outdoor reference.

K. Roof Curbs:

1. Materials: Galvanized steel with corrosion-resistant coating, watertight gaskets, and factory-installed wood nailer; complying with National Roofing Contractors Association manuals for the specific type of roofing applicable to the Project.

    a. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

        1) Materials: ASTM C1071, Type I or II.

    b. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

        1) Liner Adhesive: Comply with ASTM C916, Type I.
        2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
        3) Liner materials applied in this location shall have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric, depending on service air velocity.

2. Curb Dimensions: Height of 14 inches.

L. Intake And Relief Openings:

1. Type: Manufacturer's standard hood or louver, including moisture eliminator, at all unit intake and relief openings.
2. Materials: Match material and finish of casing exterior.
3. Bird Screen: Comply with requirements in ASHRAE 62.1.
4. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.2 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.

2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

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.

3.2 INSTALLATION OF DEDICATED OUTDOOR-AIR UNITS

A. Roof Curb: Install on roof structure or concrete base, level and secure, in accordance with NRCA's "The NRCA Roofing Manual: Membrane Roof Systems". Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

C. Install filter-gauge, static-pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum in accessible position. Provide filter gauges on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

D. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.

E. Comply with requirements for gas-fired furnace installation in NFPA 54.

F. Install separate devices furnished by manufacturer and not factory installed.

G. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to units, allow space for service and maintenance.

C. Connect piping to units mounted on vibration isolators with flexible connectors.

D. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

E. Duct Connections:

1. Drawings indicate the general arrangement of ducts.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Inspect units for visible damage to furnace combustion chamber.
3. Perform the following operations for both minimum and maximum firing, and adjust burner for peak efficiency:

    a. Measure gas pressure at manifold.
    b. Measure combustion-air temperature at inlet to combustion chamber.
    c. Measure flue-gas temperature at furnace discharge.
    d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

4. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:

    a. High-limit heat exchanger.
    b. Alarms.

5. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
6. Start refrigeration system when outdoor-air temperature is within normal operating limits. and measure and record the following:

a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
b. Cooling coil entering-air, dry- and wet-bulb temperatures.
c. Condenser coil entering-air dry-bulb temperature.
d. Condenser coil leaving-air dry-bulb temperature.

7. Simulate maximum cooling demand and inspect the following:

a. Compressor refrigerant suction and hot-gas pressures.
b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.

8. Inspect casing insulation for integrity, moisture content, and adhesion.
9. Verify that clearances have been provided for servicing.
10. Verify that controls are connected and operable.
11. Verify that filters are installed.
12. Clean coils and inspect for construction debris.
13. Clean furnace flue and inspect for construction debris.
14. Inspect operation of power vents.
15. Purge gas line.
16. Inspect and adjust vibration isolators and seismic restraints.
17. Verify bearing lubrication.
18. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
19. Adjust fan belts to proper alignment and tension.
20. Start unit.
21. Inspect and record performance of interlocks and protective devices, including response to smoke detectors by fan controls and fire alarm.
22. Operate unit for run-in period.
23. Calibrate controls.
24. Adjust and inspect high-temperature limits.
25. Inspect outdoor-air dampers for proper stroke.
26. Verify operational sequence of controls.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate, and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.7 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within **12** months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

3.8 CLEANING

A. After completing system installation; testing, adjusting, and balancing dedicated outdoor-air unit and air-distribution systems; and completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, casings, dampers, coils, and filter housings, and install new, clean filters.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
2. Charge refrigerant coils with refrigerant and test for leaks.
3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Split-system air-conditioners.

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: Five year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SPLIT-SYSTEM AIR-CONDITIONERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Carrier Global Corporation.
2. Lennox Industries, Inc.; Lennox International.
3. Trane.

B. Outdoor Units (5 tons (18 kW) or Less)

1. Air-Cooled, Compressor-Condenser Components:

a. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

b. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1) Compressor Type: Scroll.
2) Refrigerant: R-410A.
3) Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

c. Fan: Aluminum-propeller type, directly connected to motor.
d. Motor: Permanently lubricated, with integral thermal-overload protection.
e. Low Ambient Kit: Permits operation down to 0 deg F.
f. Mounting Base: Polyethylene.

C. Accessories:

1. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
2. Automatic-reset timer to prevent rapid cycling of compressor.
3. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
4. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Nonmetallic-sheathed cable is not permitted.

C. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

D. Health care rated metal-clad cable is permitted only as follows:

1. Where concealed above accessible ceilings for final connections from junction boxes to luminaires

    a. Maximum Length: 5 feet.

2. Where concealed within walls, between studs for final connections from receptacles to junction box at top of wall, above concealed ceiling.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Comply with NEMA WC 70

D. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83

E. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL-44

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

G. Conductor Material

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project.
2. Copper Conductors: Soft drawn annealed, 98% conductivity, uncoated copper conductors complying with ASTM B 3, ASTM B 8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33

H. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
3. Color Code

a. 208Y/120V, 3 phase, 4 Wire System:

1) Phase A: Black
2) Phase B: Red
3) Phase C: Blue
4) Neutral/Grounded: White

b. Equipment Ground, All systems: Green

2.3 COPPER BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Bare Conductor.
2. Southwire Company.
3. WESCO.

C. Standards:

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

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

E. Conductor Insulation:

1. Type THHN/THWN or Type THHN/THWN-2: Comply with UL 83.
2. Insulation voltage rating: 600 V

2.4 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Bare Conductor.
2. Southwire Company.
3. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit.
2. Healthcare rated MC may be used for lighting fixture whips up to 5 feet long, one per fixture, not daisy-chained.
3. Healthcare rated MC may be used where concealed within walls to junction box / receptacle.

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

F. Ground Conductor: Insulated.

G. Minimum Conductor size is #12 AWG

H. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

I. Minimum insulation rating is 90°C

J. Armor: Steel, interlocked.

K. Jacket: PVC applied over armor.

2.5 CONNECTORS AND SPLICES

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

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. 3M Electrical Products.
2. ABB (Electrification Products Division).
3. Hubbell Incorporated (Hubbell Power Systems).

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

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

1. Material: Copper.
2. Type: One hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

B. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

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

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding bushings.
4. Grounding and bonding hubs.
5. Grounding and bonding connectors.
6. Grounding and bonding busbars.
7. Grounding (earthing) electrodes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product indicated.

B. Shop Drawings: Plans showing dimensioned locations of grounding features described in "Field Quality Control" Article, including the following:

1. Test wells.
2. Rod electrodes.
3. Ring electrodes.
4. Grounding arrangements and connections for separately derived systems.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Plans showing locations of grounding features described in "Field Quality Control" Article, including the following:

a. Test wells.
b. Rod electrodes.
c. Ring electrodes.
d. Grounding arrangements and connections for separately derived systems.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, THHN/THWN-2, copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. ASTM - Bare Copper Grounding and Bonding Conductor:

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

   a. ERICO; brand of nVent Electrical plc.
   b. Harger Lightning & Grounding; business of Harger, Inc.

2. Referenced Standards: Complying with one or more of the following:

   a. Soft or Annealed Copper Wire: ASTM B3
   b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
   c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
   d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.2 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications; see Section 270526 "Grounding and Bonding for Communications Systems," for selection and installation guidelines.

B. Performance Criteria:

1. Regulatory Requirements:

   a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

   a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
   b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

2.3 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

B. Performance Criteria:

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.4 GROUNDING AND BONDING HUBS

A. Description: Hubs with certified grounding or bonding locknut.

B. Performance Criteria:

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.5 GROUNDING AND BONDING CONNECTORS

A. Performance Criteria:

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.6 GROUNDING AND BONDING BUSBARS

A. Description: Miscellaneous grounding and bonding device that serves as common connection for multiple grounding and bonding conductors.

B. Performance Criteria:

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.7 GROUNDING (EARTHING) ELECTRODES

A. Description: Grounding electrodes include rod electrodes, ring electrodes, metal underground water pipes, metal building frames, concrete-encased electrodes, and pipe and plate electrodes.

B. Performance Criteria:

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of electrical service equipment connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF BUSBARS

A. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inch minimum from wall, 6 inch above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.3 SELECTION OF GROUNDING AND BONDING CONDUCTORS

A. Conductors: Install solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.

B. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.

C. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.

D. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.

E. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

F. Underground Grounding Conductors: Install bare copper conductor, 2/0 AWG minimum.

1. Bury at least 30 inch below grade.

3.4 SELECTION OF CONNECTORS

A. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.5 SELECTION OF GROUND RODS

A. 5/8” x 10 ft. copper clad steel, UL listed.

3.6 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Special Techniques:

1. Conductors:

a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

2. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
b. Make connections with clean, bare metal at points of contact.
c. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
d. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.

e. Grounding and Bonding for Piping:

1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.
3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

f. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
g. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft apart.

3. Electrodes:

a. Ground Rods: Drive rods until tops are 2 inch below finished floor or final grade unless otherwise indicated.

1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2) Use exothermic welds for below-grade connections.

b. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.
c. Test Wells: Ground rod driven through drilled hole in bottom of handhole.

1) Install at least one test well for each service unless otherwise indicated. Install at ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

d. Ring Electrode: Install grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around perimeter of building.

1) Install tinned-copper conductor not less than 2/0 AWG for ring electrode and for taps to building steel.
2) Bury ring electrode not less than 24 inch from building's foundation.

e. Concrete-Encased Electrode (Ufer Ground):

1) Fabricate in accordance with NFPA 70; use minimum of 20 ft of bare copper conductor not smaller than 4 AWG.

a) If concrete foundation is less than 20 ft long, coil excess conductor within base of foundation.
b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

2) Fabricate in accordance with NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft long. If reinforcing is in multiple pieces, connect together by usual steel tie wires or exothermic welding to create required length.

4. Grounding at Service:

a. Equipment grounding conductors and grounding electrode conductors must be connected to ground bus. Install main bonding jumper between neutral and ground buses.

5. Grounding Underground Distribution System Components:

a. Comply with IEEE C2 grounding requirements.
b. Grounding Handholes: Install driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch will extend above finished floor. If necessary, install ground rod before manhole is placed and provide 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch above to 6 inch below concrete. Seal floor opening with waterproof, nonshrink grout.
c. Pad-Mounted Transformers and Switches: Install two ground rods and ring electrode around pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than 2 AWG for ring electrode and for taps to equipment grounding terminals. Bury ring electrode not less than 6 inch from foundation.

6. Equipment Grounding:

a. Install insulated equipment grounding conductors with feeders and branch circuits.
b. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1) Feeders and branch circuits.
2) Lighting circuits.
3) Receptacle circuits.
4) Single-phase motor and appliance branch circuits.
5) Three-phase motor and appliance branch circuits.
6) Flexible raceway runs.
7) Armored and metal-clad cable runs.
8) Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

c. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method in accordance with IEEE Std 81.
    c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to record of tests and observations. Include number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Nonconforming Work:

1. Grounding system will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective components and retest.

C. Collect, assemble, and submit test and inspection reports.

1. Report measured ground resistances that exceed the following values:

    a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ω.
    b. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 Ω.
    c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 Ω.
    d. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 Ω.
    e. Substations and Pad-Mounted Equipment: 5 Ω.

3.8 PROTECTION

A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper B-Line, Inc.; a division of Cooper Industries.
b. ERICO International Corporation.
c. Thomas & Betts Corporation, A Member of the ABB Group.

2. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
3. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Hilti, Inc.
3) ITW Ramset/Red Head; Illinois Tool Works, Inc.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

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

END OF SECTION

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.
4. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allied Tube & Conduit; a part of Atkore International.
b. Thomas & Betts Corporation; A Member of the ABB Group.
c. Wheatland Tube Company.

2. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. GRC: Comply with ANSI C80.1 and UL 6.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. FMC: Comply with UL 1; zinc-coated steel.
6. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Allied Tube & Conduit; a part of Atkore International.
   b. Thomas & Betts Corporation; A Member of the ABB Group.
   c. Wheatland Tube Company.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
5. Fittings for EMT:

   a. Material: Steel.
   b. Type: Setscrew.

6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit: Shall not be used.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hoffman; a brand of Pentair Equipment Protection.
2. RACO; Hubbell.
3. Thomas & Betts Corporation; A Member of the ABB Group.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Shall not be used.

F. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

L. Gangable boxes are allowed.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits.

Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

I. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

J. Support conduit within 12 inchesof enclosures to which attached.

K. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

L. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

T. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for whips from junction boxes to single light fixtures.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

U. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

V. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

W. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

X. Locate boxes so that cover or plate will not span different building finishes.

Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to

provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for conductor and communication- and control- cable.
2. Warning labels and signs.
3. Equipment identification labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 EQUIPMENT IDENTIFICATION LABELS

A. Permanent Engraved nameplate

1. Nameplates shall be engraved three-layer Laminated Acrylic or Melamine Label: Adhesive backed, with black letters on a white background. Minimum letter height shall be 3/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Power.
2. UPS.

C. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

D. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

E. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

F. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Laminated acrylic or melamine label 4 inches high.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Electrical switchgear and switchboards.
c. Disconnect switches.
d. Enclosed circuit breakers.
e. Contactors.

3.3 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Color-Coding for Phase Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

END OF SECTION

SECTION 260573.19 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Computer-based, arc-flash study to determine arc-flash hazard distance and incident energy to which personnel could be exposed during work on or near electrical equipment.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For power system analysis software to be used for studies.

B. Study Submittals:

1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form:

a. Arc-flash study input data, including completed computer program input data sheets.
b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
c. Revised one-line diagram, reflecting field investigation results and results of arc-flash study.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.4 QUALITY ASSURANCE

A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms must comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

1.5 REGULATORY AGENCY APPROVALS

A. Submittals for arc-flash hazard analysis requiring approval by authorities having jurisdiction must be signed and sealed by qualified electrical professional engineer responsible for their preparation. Submit for action by Architect prior to submitting for approval by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CYME International T&D Inc.; subsidiary of Eaton Corporation plc.
2. ETAP; brand of Operation Technology, Inc.; subsidiary of Schneider Electric.
3. SKM Systems Analysis, Inc.

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kVA and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

F. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.

e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

G. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

H. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce 3.5 by 5 inch self-adhesive equipment label for each work location included in analysis.

B. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.

a. Arc-flash boundary.
b. Restricted approach boundary.
c. Limited approach boundary.

4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels must be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.

C. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

D. Include medium- and low-voltage equipment locations, except equipment fed from transformers smaller than 75 kVA.

E. Calculate limited, restricted, and prohibited approach boundaries for each location.

F. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must take into account changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:

1. Fault contribution from induction motors must not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).

G. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:

1. When circuit breaker is in separate enclosure.
2. When line terminals of circuit breaker are separate from work location.

H. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain data necessary for conduct of arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings. Call discrepancies to Architect's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.

3.4 LABELING

A. Apply one arc-flash label on front cover for each equipment included in study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below must have arc-flash label applied to it:

1. Panelboards.

C. Note on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Indoor occupancy and vacancy sensors.
2. Switchbox-mounted occupancy and vacancy sensors

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Hubbell Incorporated (Hubbell Control Solutions).
3. Leviton Manufacturing Co., Inc.
4. Lithonia Lighting; Acuity Brands Lighting, Inc.
5. Lutron Electronics Co., Inc.
6. Sensor Switch, Inc.

B. General Requirements for Sensors:

1. Ceiling-mounted, solid-state indoor occupancy sensors.
2. Dual technology.
3. Separate power pack.
4. Hardwired connection to switch and BAS.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:

    a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: Sensor is powered from the power pack.
8. Power: Control voltage.
9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.2 SWITCHBOX-MOUNTED VACANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cooper Industries, Inc.
2. Hubbell Incorporated (Hubbell Control Solutions).
3. Leviton Manufacturing Co., Inc.
4. Lithonia Lighting; Acuity Brands Lighting, Inc.
5. Lutron Electronics Co., Inc.
6. Sensor Switch, Inc.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Vacancy Sensor Operation: Unless otherwise indicated, turn lights on manually, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V, and 800-W incandescent.

C. Wall-Switch Sensor:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft..
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, dual circuit, manual "on," automatic "off."
4. Capable of controlling load in three-way application.
5. Voltage: Match the circuit voltage.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Color: White.
8. Faceplate: Color matched to switch.

2.3 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

C. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

D. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

E. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Include evidence of NRTL listing for SPD as installed in panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Key interlock scheme drawing and sequence of operations.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Source Limitations: Obtain all panelboards from single source from single manufacturer.

2.2 PANELBOARDS COMMON REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Height: 84 inches maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.

E. Incoming Mains Location: Convertible between top and bottom.

F. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

H. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

J. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

2.3 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.4 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Mains: Circuit breaker or lugs only.

C. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker or lugs only.

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

    a. Inverse time-current element for low-level overloads.
    b. Instantaneous magnetic trip element for short circuits.
    c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
5. Subfeed Circuit Breakers: Vertically mounted.
6. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. UL listed for reverse connection without restrictive line or load ratings.
    d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    g. Shunt Trip: 24-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.7 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

2.8 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NEMA PB 1.1.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box.

E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

H. Install filler plates in unused spaces.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, 20 A.
2. GFCI receptacles, 125 V, 20 A.
3. Toggle switches, 120/277 V, 20 A.
4. Wall plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Device Color:

1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Essential Electrical System: Red.
3. SPD Devices: Blue.
4. Isolated-Ground Receptacles: Orange.

F. Wall Plate Color: For plastic covers, match device color.

G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Hubbell Incorporated (Wiring Device-Kellems).
2. Legrand North America, LLC (Pass & Seymour).
3. Leviton Manufacturing Co., Inc.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.4 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole, Two-Pole, Three-Way, and Four-Way Switches, 120/277 V, 20 A:

1. Standards: Comply with UL 20 and FS W-S-896.

2.5 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
2. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
3. Install wiring devices after all wall preparation, including painting, is complete.

C. Device Installation:

1. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

F. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. ABB, Electrification Business
4. Siemens Industry, Inc.
5. Square D.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton Electrical Sector; Eaton Corporation.
2. General Electric Company.
3. Siemens Industry, Inc.
4. Square D.
5. ABB, Electrification Business

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business

2. Eaton Electrical Sector; Eaton Corporation.
3. General Electric Company.
4. Siemens Industry, Inc.
5. Square D.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 100 A and larger.

D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

F. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes nonautomatic transfer switches rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
2. Single-Line Diagram: Show connections between transfer switch, power sources, and load.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 12 months 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.

B. Comply with NEMA ICS 1.

C. Comply with UL 1008 unless requirements of these Specifications are stricter.

D. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

E. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

F. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

G. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

H. Service-Rated Transfer Switch:

1. Comply with UL 869A and UL 489.
2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
3. In systems with a neutral, the bonding connection shall be on the neutral bus.
4. Provide removable link for temporary separation of the service and load grounded conductors.
5. Surge Protective Device: Service rated.
6. Service Disconnecting Means: Externally operated, manual mechanically actuated.

I. Neutral Switching: Where four-pole switches are indicated, provide overlapping neutral contacts.

J. Neutral Terminal: Solid and fully rated unless otherwise indicated.

K. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 NONAUTOMATIC TRANSFER SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ASCO Power Technologies.
2. Cummins Power Generation.
3. Eaton.

B. Electrically Operated: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

C. Manual and Electrically Operated: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.

D. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.

E. Pilot Lights: Indicate source to which load is connected.

F. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternative-source sensing circuits.

1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

2. Emergency Power Supervision: Red light with nameplate engraved "Alternative Source Available."

G. Unassigned Auxiliary Contacts: Switch shall have one set of normally closed contacts for each switch position, rated 10 A at 240-V ac.

H. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Switch Action: Double throw; mechanically held in both directions.
2. Contacts: Silver composition or silver alloy for load-current switching.
3. Conductor Connectors: Suitable for use with conductor material and sizes.
4. Material: Hard-drawn copper, 98 percent conductivity.
5. Main and Neutral Lugs: Mechanical type.
6. Ground Lugs and Bus-Configured Terminators: Mechanical type.
7. Connectors shall be marked for conductor size and type according to UL 1008.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

B. Prepare test and inspection reports.

1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:

a. Overvoltage.
b. Undervoltage.
c. Loss of supply voltage.
d. Reduction of supply voltage.
e. Alternative supply voltage or frequency is at minimum acceptable values.
f. Temperature rise.
g. Dielectric voltage-withstand; before and after short-circuit test.
h. Overload.
i. Contact opening.
j. Endurance.
k. Short circuit.
l. Short-time current capability.
m. Receptacle withstand capability.
n. Insulating base and supports damage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor-Mounting Switch: Anchor to floor by bolting.

1. Install transfer switches on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

3. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
4. Provide workspace and clearances required by NFPA 70.

B. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.

C. Identify components according to Section 260553 "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

E. Comply with NECA 1.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets,control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Route and brace conductors according to manufacturer's written instructions. Do not obscure manufacturer's markings and labels.

F. Brace and support equipment according to Section 260548.16 "Seismic Controls for Electrical Systems."

G. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with Drawings and Specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and required clearances.
d. Verify that the unit is clean.
e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
f. Verify that manual transfer warnings are attached and visible.
g. Verify tightness of all control connections.
h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:

1) Use of low-resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.

i. Perform manual transfer operation.
j. Verify positive mechanical interlocking between normal and alternate sources.
k. Perform visual and mechanical inspection of surge arresters.
l. Inspect control power transformers.

1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

2. Electrical Tests:

a. Perform insulation-resistance tests on all control wiring with respect to ground.
b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
c. Verify settings and operation of control devices.
d. Calibrate and set all relays and timers.
e. Verify phase rotation, phasing, and synchronized operation.
f. Perform automatic transfer tests.
g. Verify correct operation and timing of the following functions:

1) Normal source voltage-sensing and frequency-sensing relays.
2) Engine start sequence.
3) Time delay on transfer.
4) Alternative source voltage-sensing and frequency-sensing relays.
5) Automatic transfer operation.
6) Interlocks and limit switch function.
7) Time delay and retransfer on normal power restoration.
8) Engine cool-down and shutdown feature.

3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

4. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

B. Coordinate tests with tests of generator and run them concurrently.

C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

D. Transfer switches will be considered defective if they do not pass tests and inspections.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luminaires.

B. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" specifies wiring connections installed by this Section.
2. Section 260529 "Hangers and Supports for Electrical Systems" specifies channel and angle supports installed by this Section.
3. Section 260923 "Lighting Control Devices" specifies automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors installed by this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALIFICATIONS

A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures; conduct tests of complex equipment; analyze test and equipment data; plan a job; and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.

B. Electrical Power Testing (EPT) Technician IV: Possessing active NICET EPT Level IV certification. Able to conduct tests of complex metering and relay systems; evaluate tests, test equipment, test results, and power system performance; recommend actions to maintain or improve system performance; and lead multi-team projects.

C. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

D. Luminaire Photometric Testing Laboratory: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" accredited under NIST HB 150-1, and complying with applicable IES testing standards.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 LUMINAIRES

A. Surface-Mounted Luminaire:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Lighting Solutions; Signify North America Corp.
    b. H.E. Williams.
    c. Lithonia Lighting; Acuity Brands Lighting, Inc.

2. Listing Criteria:
    a. LED Luminaires: UL CCN IFAM; including UL 1598.
3. Standard Features:

    a. Openings: Doors, frames, and access panels must operate smoothly, not leak light under operating conditions, and permit relamping without use of tools or parts falling from enclosure.
    b. CRI: 80+.
    c. Ballast or Driver Location: Internal.

B. Recessed Luminaire:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Lighting Solutions; Signify North America Corp.
    b. Focal Point; Legrand North America, LLC.
    c. Lithonia Lighting; Acuity Brands Lighting, Inc.

2. Listing Criteria:
    a. LED Luminaires: UL CCN IFAO; including UL 1598
    b. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.
3. Standard Features:

    a. Ceiling Compatibility: NEMA LE 4.
    b. Openings: Doors, frames, and access panels must operate smoothly, not leak light under operating conditions, and permit relamping without use of tools or parts falling from enclosure.
    c. CRI: 80+.
    d. Ballast or Driver Location: Internal.

    e. LED Luminaires (UL CCN IFAO):
        1) Efficacy: Not less than 85 lm/W.
        2) Rated Life: 35 000 hours to L70.

C. UL FTBR or FTBV - Emergency Lighting and Power Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Cooper Lighting Solutions; Signify North America Corp.
    b. Dual-Lite; brand of GE Current, a Daintree company; American Industrial Partners (AIP).

c. Lithonia Lighting; Acuity Brands Lighting, Inc.

2. Listing Criteria:

a. Emergency Lighting and Power: UL CCN FTBR or UL CCN FTBV; including UL 924, NFPA 101, and ICC IBC.
b. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.

3. Standard Features:

a. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
b. Status and Test Indication: Visible and accessible without opening luminaire or entering ceiling space.

1) Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
2) Test Push-Button: Push-to-test button in unit housing simulates loss of normal power and demonstrates unit operability.

c. Enclosure: UV stable thermoplastic housing rated for damp locations.

D. UL FWBO - Exit Fixture:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Cooper Lighting Solutions; Signify North America Corp.
b. Hubbell Lighting; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
c. Lithonia Lighting; Acuity Brands Lighting, Inc.

2. Listing Criteria:

a. Exit Fixtures: UL CCN FWBO; including UL 924, NFPA 101, and ICC IBC.
b. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.

3. Standard Features:
a. Light Source: LED; 50,000 hours minimum rated life.
b. Legend Color: Red.
c. Internal emergency power unit.
d. Battery Type: Ni-Cd.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING

A. Temporary Lighting: If approved by Architect, specified luminaires for the Project may be installed for temporary lighting. Install and energize minimum quantity of luminaires necessary to meet needs of construction activities. When construction is sufficiently complete, remove, disassemble, clean, and relamp luminaires used for temporary lighting before reinstalling for the Project's delivery.

B. Comply with manufacturer's published instructions.

C. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
2. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
3. Work in Confined Spaces: NFPA 350.
4. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
5. Installation of Indoor Lighting Systems: NECA NEIS 500.
6. Installation of Exterior Lighting Systems: NECA NEIS 501.
7. Installation of Industrial Lighting Systems: NECA NEIS 502.
8. Installation of Luminaires, Lampholders, and Lamps: Article 410 of NFPA 70.
9. Installation of Extra-Low-Voltage Lighting: Article 411 of NFPA 70.
10. Installation of Lighting for Sensitive Electronic Equipment: Article 647 of NFPA 70.
11. Installation of Emergency Lighting and Exit Signs: ICC IBC, NFPA 101, and Parts IV and V in Article 700 of NFPA 70.
12. Consult Architect for resolution of conflicting requirements.

D. Special Installation Techniques:

1. Install luminaires level, plumb, and square with finished floor or grade unless otherwise indicated.
2. Install luminaires at height and aiming angle as indicated on the Drawings.
3. Coordinate layout and installation of luminaires with other construction.
4. Adjust luminaires that require field adjustment or aiming.

5. Exterior In-Ground Luminaires:

    a. Install on concrete base with top 4 inch above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

6. Exterior Corrosion Prevention:

    a. Do not use aluminum in contact with earth or concrete. When in direct contact with dissimilar metals, protect aluminum with insulating fittings or treatment.
    b. When embedding steel conduits in concrete, wrap conduit with 10 mil thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

7. Flush-Mounted Luminaire Support:

    a. Secured to outlet box.
    b. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
    c. Trim ring flush with finished surface.

8. Wall-Mounted Luminaire Support: Attached to structural members in walls.

    a. Do not attach luminaires directly to gypsum board.

9. Suspended Luminaire Support:

    a. Ceiling Mount:

        1) Hook hangers.
        2) Two wires.
        3) Two aircraft cables.

b. Pendants and Rods: Where longer than 48 inch, brace to limit swinging.
c. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
d. Continuous Rows of Luminaires: Provide tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
e. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

10. Ceiling-Grid-Mounted Luminaire Support:

    a. Install ceiling support system rods or wires for each luminaire. Locate not more than 6 inch from luminaire corners.
    b. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for application.
    c. Luminaires of Sizes Smaller than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with no fewer than two 3/4 inch metal channels spanning and secured to ceiling tees.

11. Remote Mounting of Ballasts or Drivers: Do not exceed distance between ballast or driver and luminaire recommended by ballast or driver manufacturer.
12. Emergency Power Units: Secure with approved fasteners in four or more locations, spaced near corners of unit.
13. Install wiring connections for luminaires.
14. Identification: Provide labels for luminaires and associated electrical equipment.

    a. Identify field-installed conductors, interconnecting wiring, and components.
    b. Provide warning signs.
    c. Label each enclosure with engraved metal or laminated-plastic nameplate.

E. Systems Integration: Integrate lighting control devices and equipment with electrical power connections for operation of luminaires as specified.

F. Protection: After installation, protect lighting equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.2 FIELD QUALITY CONTROL OF LIGHTING

A. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
3. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
4. Verify operation of photoelectric controls.
5. Exterior Illumination Tests:

    a. Measure light intensities at night. Use photometers with calibration referenced to NIST standards.

B. Nonconforming Work:

1. Luminaire will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

3.3 CLOSEOUT ACTIVITIES

A. Training:

1. Train Owner's maintenance personnel on the following topics:

a. How to adjust, operate, and maintain luminaires and photoelectric controls.

END OF SECTION

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Addressable fire-alarm system.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Duct smoke detectors.
5. Heat detectors.
6. Multicriteria and multisensor fire detectors.
7. Fire-alarm notification appliances.
8. Digital alarm communicator transmitters (DACTs).

1.2 DEFINITIONS

A. DACT: Digital alarm communicator transmitter.

B. FACU: Fire-alarm control unit.

C. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.3 ACTION SUBMITTALS

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include voltage drop calculations for notification-appliance circuits.
3. Include battery-size calculations.
4. Include input/output matrix.
5. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.

6. Include performance parameters and installation details for each detector.
7. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
8. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
    b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
    d. Riser diagram.
    e. Device addresses.
    f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
    g. Record copy of site-specific software.
    h. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

        1) Equipment tested.
        2) Frequency of testing of installed components.
        3) Frequency of inspection of installed components.
        4) Requirements and recommendations related to results of maintenance.
        5) Manufacturer's user training manuals.

    i. Manufacturer's required maintenance related to system warranty requirements.
    j. Abbreviated operating instructions for mounting at FACU and each annunciator unit.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.
2. Installation must be by personnel certified by NICET as fire-alarm Level II technician.
3. Obtain certification by NRTL in accordance with NFPA 72.
4. Licensed or certified by authorities having jurisdiction.

1.6 FIELD CONDITIONS

PART 2 - PRODUCTS

2.1 ADDRESSABLE FIRE-ALARM SYSTEM

A. Description:

1. Noncoded, UL-certified addressable system, with multiplexed signal transmission andhorn-and-strobe notification for evacuation.

B. Performance Criteria:

1. Regulatory Requirements:

a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.

2. General Characteristics:

a. Automatic sensitivity control of certain smoke detectors.
b. Fire-alarm signal initiation must be by one or more of the following devices:

1) Manual stations.
2) Heat detectors.
3) Smoke detectors.
4) Duct smoke detectors.
5) Fire-extinguishing system operation.

c. Fire-alarm signal must initiate the following actions:

1) Continuously operate alarm notification appliances.
2) Identify alarm and specific initiating device at FACU.
3) Transmit alarm signal to remote alarm receiving station.
4) Unlock electric door locks in designated egress paths.
5) Switch HVAC equipment controls to fire-alarm mode.
6) Record events in system memory.
7) Record events by system printer.
8) Indicate device in alarm on graphic annunciator.

d. Supervisory signal initiation must be by one or more of the following devices and actions:

1) Independent fire-detection and -suppression systems.
2) FACU has lost communication with network.

e. System trouble signal initiation must be by one or more of the following devices and actions:

1) Open circuits, shorts, and grounds in designated circuits.
2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4) Loss of primary power at FACU.

5) Ground or single break in internal circuits of FACU.
6) Abnormal ac voltage at FACU.
7) Break in standby battery circuitry.
8) Failure of battery charging.
9) Abnormal position of switch at FACU or annunciator.

f. System Supervisory Signal Actions:

1) Initiate notification appliances.
2) Identify specific device initiating event at FACU.
3) Record event on system printer.
4) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.
5) Transmit system status to building management system.
6) Display system status on graphic annunciator.

g. Device Guards:

1) Description: Welded wire mesh of size and shape for manual station, smoke detector, gong, or other device requiring protection.

a) Factory fabricated and furnished by device manufacturer.
b) Finish: Paint of color to match protected device.

h. Document Storage Box:

1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.
2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
3) Color: Red powder-coat epoxy finish.
4) Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
5) Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

2.2 FIRE-ALARM CONTROL UNIT (FACU)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Gamewell-FCI; Honeywell International, Inc.
2. Notifier; Honeywell International, Inc.
3. Silent Knight; Honeywell International, Inc.

B. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

C. Performance Criteria:

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.
2. General Characteristics:

a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.
b. Include real-time clock for time annotation of events on event recorder and printer.
c. Provide communication between FACU and remote circuit interface panels, annunciators, and displays.
d. FACU must be listed for connection to central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.
f. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.

    1) Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: FACU must be listed for releasing service.

g. Smoke-Alarm Verification:

    1) Initiate audible and visible indication of "alarm-verification" signal at FACU.
    2) Activate approved "alarm-verification" sequence at FACU and detector.
    3) Record events by system printer.
    4) Sound general alarm if alarm is verified.
    5) Cancel FACU indication and system reset if alarm is not verified.

h. Notification-Appliance Circuit:

    1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.
    2) Where notification appliances provide signals to sleeping areas, alarm signal must be 520 Hz square wave with intensity 15 dB above average ambient sound level or 5 dB above maximum sound level, or at least 75 dB(A-weighted), whichever is greater, measured at pillow.
    3) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.

i. Remote Smoke-Detector Sensitivity Adjustment: Controls must select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out final adjusted values on system printer.
j. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to remote alarm station.
k. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of central-control microphone. Amplifiers must comply with UL 1711.

    1) Allow application of, and evacuation signal to, indicated number of zones and simultaneously allow voice paging to other zones selectively or in combination.
    2) Programmable tone and message sequence selection.
    3) Standard digitally recorded messages for "Evacuation" and "All Clear."

4) Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of FACU.

l. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory signals must be powered by 24 V(dc) source.
m. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.
n. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.

2.3 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
2. Double-action mechanism requiring two actions to initiate alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.
3. Station Reset: Key- or wrench-operated switch.
4. Material: Manual stations made of Lexan polycarbonate.
5. Able to be used in indoor areas.

2.4 SYSTEM SMOKE DETECTORS

A. Photoelectric Smoke Detectors:

1. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.

b. General Characteristics:

1) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
2) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
3) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
4) Integral Visual-Indicating Light: LED type, indicating detector has operated.
5) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
6) Operator at FACU, having designated access level, must be able to manually access the following for each detector:

a) Primary status.
b) Device type.
c) Present average value.

d) Present sensitivity selected.
e) Sensor range (normal, dirty, etc.).

7) Detector must have functional humidity range within 10 to 90 percent relative humidity.
8) Multiple levels of detection sensitivity for each sensor.
9) Sensitivity levels based on time of day.

2.5 DUCT SMOKE DETECTORS

A. Description: Photoelectric-type, duct-mounted smoke detector.

B. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.
b. UL 268A.

2. General Characteristics:

a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
b. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
c. Integral Visual-Indicating Light: LED type, indicating detector has operated.
d. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
e. Operator at FACU, having designated access level, must be able to manually access the following for each detector:

1) Primary status.
2) Device type.
3) Present average value.
4) Present sensitivity selected.
5) Sensor range (normal, dirty, etc.).

f. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.
g. Each sensor must have multiple levels of detection sensitivity.
h. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

2.6 HEAT DETECTORS

A. Combination-Type Heat Detectors:

1. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.
2) UL 521.

b. General Characteristics:

1) Temperature sensors must test for and communicate sensitivity range of device.

c. Actuated by fixed temperature of 135 deg F or rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
d. Mounting: Adapter plate for outlet box mounting.
e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
f. Detector must have functional humidity range of 10 to 90 percent relative humidity.

2.7 FIRE-ALARM NOTIFICATION APPLIANCES

A. Fire-Alarm Audible Notification Appliances:

1. Description: Horns, bells, or other notification devices that cannot output voice messages.
2. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.

b. General Characteristics:

1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
3) Audible notification appliances must have functional humidity range of 10 to 95 percent relative humidity.
4) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce sound-pressure level of 90 dB(A-weighted), measured 10 ft. from horn, using coded signal prescribed in UL 464 test protocol.
5) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Fire-Alarm Visible Notification Appliances:

1. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.
2) UL 1971.

b. General Characteristics:

1) Rated Light Output:

a) 15/30/75/110 cd, selectable in field.

2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
3) Mounting: Wall mounted unless otherwise indicated.
4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.

5) Flashing must be in temporal pattern, synchronized with other units.
6) Strobe Leads: Factory connected to screw terminals.
7) Mounting Faceplate: Factory finished, red.

2.8 DIGITAL ALARM COMMUNICATOR TRANSMITTERS (DACTs)

A. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.

2. General Characteristics:

a. DACT must be acceptable to remote central station and must be listed for fire-alarm use.
b. Functional Performance: Unit must receive alarm, supervisory, or trouble signal from FACU and automatically capture two telephone line(s) and dial preset number for remote central station. When contact is made with central station(s), signals must be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter must initiate local trouble signal and transmit signal indicating loss of telephone line to remote alarm receiving station over remaining line. Transmitter must automatically report telephone service restoration to central station. If service is lost on both telephone lines, transmitter must initiate local trouble signal.
c. Local functions and display at DACT must include the following:

1) Verification that both telephone lines are available.
2) Programming device.
3) LED display.
4) Manual test report function and manual transmission clear indication.
5) Communications failure with central station or FACU.

d. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.

B. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

3.3 INSTALLATION OF EQUIPMENT

A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before other trades have completed cleanup must be replaced.
2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inch above finished floor.

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.
2. Mount manual fire-alarm box on background of contrasting color.
3. Operable part of manual fire-alarm box must be between 42 and 48 inch above floor level. Devices must be mounted at same height unless otherwise indicated.

D. Smoke- and Heat-Detector Spacing:

1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing must not exceed 30 ft..
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex Ain NFPA 72.
5. HVAC: Locate detectors not closer than 36 inch from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inch from lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

H. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install not less than 6 inch below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.

K. Device Location-Indicating Lights: Locate in public space near device they monitor.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.6 PATHWAYS

A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inch above floor must be installed in EMT.

3.7 CONNECTIONS

A. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.

3.8 GROUNDING

A. Ground FACU and associated circuits in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Ground shielded cables at control panel location only. Insulate shield at device location.

3.9 FIELD QUALITY CONTROL

A. Administrant for Tests and Inspections:

1. Administer and perform tests and inspections with assistance of factory-authorized service representative.

B. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.

2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

3.11 MAINTENANCE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

END OF SECTION

SECTION 31 1000 – SITE CLEARING & DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Remove and relocate guy wires for utility poles as needed for grade work to commence.

B. Remove and replacement of pavement and gravel as required.

C. It is the intent that the demolition be complete and adequate for the intended purpose. This work shall include the removal of all items, whether in view or hidden underneath the surface of the ground, regardless of whether shown on the drawings or encountered during construction.

1.2 PERMITS

A. Contractor shall comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess waste materials.

1.3 SUBMITTALS

A. The contractor shall submit demolition and clearing procedures and operational sequences and schedules for review and acceptance by the Owner's representative.

1.4 GENERAL PROCEDURES

A. Erect barriers to protect personnel, structures and utilities remaining intact.

B. Protect all neighboring landscaping and trees are to be protected from damage.

C. Protect all existing objects intended to remain. In case of damage, make repairs or replacements necessary at no additional cost to the owner.

D. Minimize interference with roads, streets, driveways, sidewalks, and adjacent facilities.

E. Do not close or obstruct streets, sidewalks, alleys or passageways without permission from authorities having jurisdiction.

F. If closure is permitted, provide signage indicating closure and signage to direct traffic to alternate route.

G. Moisten surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

PART 2 EXECUTION

2.1 PREPERATION

A. Notification: Provide the owner's representative a minimum of two business days' notice

prior to commencing work of this section.

B. The contractor shall locate existing utility lines and services traversing the site and determine the requirements for their protection. The contractor shall preserve active utilities on the site that are designated to remain.

C. Before starting site operations, the contractor shall disconnect or arrange for the disconnection of all utility services designated to be removed. The contractor shall perform all such work in accordance with the requirements of the utility company or agency involved

2.2 PAVEMENTS

A. In removing pavement, curb and gutter, sidewalks, etc., where a portion is left in place, removal shall be to an existing joint or to a joint sawed to a minimum depth of 2" with a true saw line and a vertical face. Remove sufficient pavement to provide for proper grade and connections in the new work regardless of any limits indicated on the drawing.

2.3 SEWERS

A. Existing castings and culverts, if salvageable and removed intact, remain the property of the contractor.

B. All sewers and drainage pipes, which have been or are to be abandoned, shall be permanently sealed at the ends with bulkheads constructed of concrete, having a minimum thickness of 8".

C. Abandon storm or sanitary sewer structures by breaking the concrete bottom of the structure into pieces no larger than 12" in any direction and removing the top of the structure to 3" below finished grade. Plug all pipes with concrete and fill structure with 1" clean gravel.

2.4 DISPOSAL

A. All debris shall be disposed of off-site

B. Do not store or burn materials on-site unless permitted by the governing jurisdiction.

C. All asphalt or concrete materials shall be disposed of off-site.

2.5 CONSTRUCTION LIMITS

A. The Contractor's operations shall be restricted to those areas inside the construction limits indicated on the drawings. If limits are not indicated, restrict work to the owner's property, easement, or public rights-of-way.

B. Complete work within public rights-of-way under the permission of the governing agency.

C. The contractor shall repair damage outside the construction limits at no additional expense to the owner.

2.6 UTILITY ADJUSTMENT

A. The contractor is responsible for the adjustment of all gas vents, manholes, castings, and water valves within the grading limits to match the finished surface.

B. Adjustments shall be coordinated with the utility companies and the cost for all adjustments shall be incidental to construction unless noted as a bid item.

C. The contractor shall repair any damage to utility structures and appurtenances that occurs during construction at no additional cost to the owner.

END OF SECTION 31 1000

SECTION 31 2000 – EARTH MOVING

PART 1 GENERAL

1.1 SUMMARY

A. Provide earthwork operations. The Contractor shall be responsible for the excavation of all footings and foundations in addition to preparing the pavement subgrade. The Contractor shall extend all utility excavations and services and make final, permanent connections to utility services as required.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Test Reports: Submit for approval test reports, list of materials and gradations proposed for use. Obtain samples of any proposed fill material and contractor to provide standard proctor test reports to engineer. Supply in-place compaction reports from an independent testing service for all fill materials placed.

1.3 QUALITY ASSURANCE

A. Compaction:
   1. Under structures, building slabs, steps, pavements, and walkways, 95 percent Standard Proctor minimum density, ASTM D 1557.
   2. Under lawns or unpaved areas, 90 percent, ASTM D 1557.

B. Grading Tolerances Outside Building Lines:
   1. Lawns, unpaved areas, and walks, plus or minus 1 inch.
   2. Pavements, plus or minus 1/2 inch

PART 2 PRODUCTS

2.1 MATERIALS

A. Earthwork:
   1. Application: Excavation, filling, compacting and grading operations both inside and outside building limits as required for below-grade improvements and to achieve grades and elevations indicated. Provide trenching and backfill for mechanical and electrical work and utilities. Note: all graded gravel or crushed stone shall be provided by the Contractor.
   2. Application: Subbase materials, drainage fill, common fill, and structural fill materials for slabs, pavements, and improvements.
   3. Application: Suitable fill from off-site if on-site quantities are insufficient or unacceptable, and legal disposal of excess fill off-site.
   4. Subbase Material: Graded gravel or crushed stone.
   5. Bedding Course: Graded crushed gravel and sand.
   6. Borrow Soil: Off-site soil for fill or backfill.
   7. Drainage Fill: ashed gravel or crushed stone.
   8. Common Fill: Mineral soil free from unsuitable materials.
   9. Structural Fill: Graded gravel.
   10. Impervious Fill: Gravel and sand mixture.

PART 3 EXECUTION

3.1 INSTALLATION

A. All activities will be contained within construction boundaries indicated on site plan. Specified excavation requirements, precautions, and protective systems will be observed at all times.

B. Movement of trucks and equipment on Owner's property will be in accordance with Owner's instructions.

C. Topsoil will be stripped from the construction site and stockpiled in designated area. Excess topsoil will be stripped and disposed of legally off site.

D. Trenches will not be backfilled until all required tests are completed and the utility systems, as installed, conform to requirements specified by the contract documents.

E. Excavation is unclassified and includes excavation to subgrade regardless of materials encountered. Repair excavations beyond elevations and dimensions indicated as follows:
   1. At Structure: Concrete or compacted structural fill.
   2. Elsewhere: Backfill and compact as directed.

F. Maintain stability of excavations; coordinate shoring and bracing as required by authorities having jurisdiction. Prevent surface and subsurface water from accumulating in excavations. Stockpile satisfactory materials for reuse, allow for proper drainage and do not stockpile materials within drip line of trees to remain.

G. Compact materials at the optimum moisture content as determined by ASTM D 1557 by aeration or wetting to the following percentages of maximum dry density:
   1. Structure, Pavement, Walkways: Subgrade and each fill layer to 95% (-2%+4%) of Standard Proctor maximum dry density to suitable depth. Compaction testing shall be performed immediately prior to the placement of reinforcing steel and new paving materials. Contractor shall be responsible for scheduling testing with qualified testing agency.
   2. Unpaved Areas: Top 6" of subgrade and each fill layer to 90% maximum dry density.
   3. A proof-roll shall be required of the subgrade prior to placement of the base course. Proof rolling shall consist of passing a loaded, 20-ton, tandem dump truck over the prepared subgrade soil with a maximum allowable displacement of 1". Any areas that displace more than 1" shall be compacted until this criterion is met, or those areas may be excavated and backfilled with compacted Type 1 aggregate used for base material. All proof rolling shall be performed in the presence of the Owner's representative.
   4. Cut areas under proposed asphalt or concrete pavements shall be cut and compacted. After grading to subgrade elevation, scarify the top six inches of the sub-base and compact as outlined above.

H. Place acceptable materials in layers not more than 8" loose depth for materials compacted by heavy equipment and not more than 4" loose depth for materials compacted by hand equipment to subgrades indicated as follows:
   1. Structural Fill: Use under foundations, slabs on grade in layers as indicated.
   2. Drainage Fill: Use under designated building slabs, at foundation drainage and elsewhere as indicated.
   3. Common Fill: Use under unpaved areas.
   4. Subbase Material: Use under pavement, walks, steps, piping and conduit.

I. Grade to within 1/2" above or below required subgrade and within a tolerance of 1/2" in 10'.

J. Protect newly graded areas from traffic and erosion. Recompact and regrade settled, disturbed and damaged areas as necessary to restore quality, appearance, and condition of work.

K. Control erosion to prevent runoff into sewers or damage to sloped or surfaced areas.

L. Control dust to prevent hazards to adjacent properties and vehicles. Immediately repair or

remedy damage caused by dust including air filters in equipment and vehicles. Clean soiled surfaces.

M. Disposal of excavation waste and unsuitable materials shall be the responsibility of the site work contractor. No specific or pre-approved location is being provided by the owner.

END OF SECTION 31 2000

SECTION 312500 – EROSION CONTROL

PART 1 - GENERAL

SECTION INCLUDES

A. Installation of temporary water pollution control measures to prevent discharge of pollutants such as chemicals, fuels, lubricants, bitumen, raw sewage, or other harmful material from the project.

B. Drawings and General Provisions of Contract, including General and Special Conditions, apply to this section.

GENERAL

C. The Contractor shall manage his operations to control water pollution in accordance with this specification and applicable State regulations. Construction of permanent drainage facilities and other contract work, contributing to control of erosion, shall be scheduled at the earliest practicable time.

D. The Contractor shall furnish, install, maintain and remove temporary erosion control measures. The Contractor shall prevent discharging silt or polluted storm water from the site.

E. The Owner's Representative may require installation of additional erosion control facilities, by the Contractor, if in the sole opinion of the Owner's Representative the Contractor's efforts are adequate.

DEFINITIONS

F. Temporary Berm: A temporary ridge of compacted soil, with or without a shallow ditch, constructed at the top of slopes or transverse to the centerline of a slope. The berm diverts storm runoff to temporary outlets to discharge water with minimal erosion.

G. Temporary Seeding and Mulching: Placement of a quick ground cover to reduce erosion in areas expected to be re-disturbed.

H. Straw Bales: Standard agricultural bales used to filter the flow of water trap, deposit sediment, and/or divert water.

I. Silt Fence: A geotextile barrier fence to contain sediment by removing suspended particles from water passing through the fence.

J. Sediment Removal: Removal of accumulated sediment to restore the efficiency of sediment control features.

SUBMITTALS

K. The Contractor shall submit any coordinate any field modifications to the “Erosion Control Plan” for review and approval by the Owner’s Representative. Approval of the plan changes does not relieve the Contractor of his contractual responsibility to prevent the discharge of pollutants into the receiving drainage ways.

PART 2 - PRODUCTS

MATERIALS

A. Temporary Seeding:
   1. December 1 to March 1: 50 lbs. oats/acre
   2. March 1 to December 1: 50 lbs. cereal rye or wheat

B. Mulch shall be wheat straw.

C. Wire Supported and Self Supporting Silt Fence:
   1. Geotextile Fabric
      a. Fibers used in geotextiles shall consist of longchain synthetic polymers, composed of at least 85 percent by weight polyolefins, polyesters, or polyamides. They shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including selvages.
      b. The geotextile shall be free of any treatment or coating which might adversely alter its physical properties after installation.
      c. Geotextile shall be furnished in 36” width rolls.
      d. Geotextile rolls shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure.
      e. Each roll shall be labeled or tagged to provide product identification sufficient for inventory.
      f. Rolls shall be stored in a manner, which protects them from the elements.
      g. Geotextile shall conform to the following:

TABLE 1
PHYSICAL REQUIREMENTS FOR
TEMPORARY SILT FENCE GEOTEXTILES

Property	Test Method	Wire Fence Supported Requirements	Self Supported Requirements
Tensile Strength, Lbs.	ASTM D4632	90 Minimum	90 Minimum
Elongation at 50% Mini-mum			
Tensile Strength (45 Lbs.)	ASTM D4632	N/A	50 Maximum
Filtering Efficiency, %	VTM-51	75	75
Flow Rate gal/ft/min	VTM-51	0.3	0.3
Ultraviolet Degradation at 500 hrs.	ASTM D4355	Minimum 70% Strength Retained	Minimum 70% Strength Retained

1. Notes: All numerical values represent minimum average roll value. When tested in any principal direction. Virginia DOT test method.

2. Posts: Wood, steel, or synthetic post may be used. Posts shall have a minimum length of 36” plus embedment depth (24” min.). Posts shall have sufficient strength to resist damage during installation and to support applied loads.
3. Support Fence: Wire or other support fence shall be at least 24” high and strong enough to support applied loads.
4. Prefabricated Fence: Prefabricated fence systems may be used provided they meet all of the above material requirements.

CLEANOUTS

D. The Contractor shall furnish a manufacturer’s certification, stating the material conforms to the requirements of these specifications.

E. The certification shall include, or have attached, typical results of tests for the specified properties, representative of the materials supplied.

F. The Owner’s Representative reserves the right to sample and test any material offered for use.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Owner’s Representative may limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, or fill operations.

B. The Owner’s Representative may direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams, other watercourses, lake, ponds, or other areas of water impoundment. Work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, use of temporary mulches, seeding or other control devices or methods to control erosion.

C. The Contractor shall incorporate permanent erosion control feature at the earliest practicable time.

D. The Contractor at no additional cost shall provide temporary pollution control measures needed to control erosion during normal construction practices to the Owner.

3.2 LIMITATION OF AREA DISTURBED

A The Owner’s Representative may limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, or fill operations.. The Contractor’s operations shall be scheduled to install erosion control features immediately after clearing and grubbing.

B. The Owner’s Representative may limit the area of clearing and grubbing, excavation, borrow, and embankment operations commensurate with the Contractor’s capability and progress in completing the finish grading, mulching seeding,

C. The Contractor shall respond to seasonal variations. If required by weather, temporary erosion control measures shall be taken immediately.

3.3 BORROW AND WASTE AREAS

A Material pits other than commercially operated sources and material spoil areas shall be subject to pollution control measures of this specification. An offsite location does not relieve the Contractor of his contractual obligation to prevent the introduction of silt or other pollutants into receiving waterways.

3.4 CONFLICT WITH FEDERAL, STATE OR LOCAL LAWS, RULES OR REGULATIONS

A In case of conflict between these requirements and pollution control laws, rules, or regulations or other Federal, State or local agencies, the more restrictive laws, rules, or regulations shall apply.

3.5 TEMPORARY BERMS

A Temporary berms shall be constructed at the top of newly constructed slopes and/or transverse to grade to divert runoff and prevent erosion until permanent controls are installed and/or slopes are stabilized.

B. Construction Requirements:

1. Berms shall be constructed to the approximate dimensions indicated on the drawings. Berms shall be machine compacted with a minimum of one pass over the entire width with a bulldozer tread, grader wheel, or other approved method.

2. Berms must drain to a compacted outlet at a slope drain. The top width of these berms may be wider and the side slopes flatter on transverse berms to allow equipment to pass over these berms with a minimal disruption.

3.6 TEMPORARY SEEDING AND MULCHING

A. General

1. This item is applicable to all projects.

2. Seeding and/or mulching shall be a continuous operation on all cut slopes, fill slopes, and borrow pits during the construction process. All disturbed areas shall be seeded and mulched within five (5) working days after the last construction activity in all locations where necessary to eliminate erosion.

B. Construction Requirements:

1. Permanent seeding and mulching following temporary seeding will be performed during the favorable seeding seasons only.

2. Temporary seeding mixtures and planting season:

a. December 1 to March 1: 50 lbs. oat grain per acre
b. March 1 to December 1: 50 lbs. (cereal rye or wheat) per acre

3. Temporary mulch, fertilizer, and lime for seeding:

4. Fertilizer and mulch for temporary seed mixtures shall be commercial type applied at the rate specified by the manufacturer.

5. Lime will not be required.

3.7 STRAW BALES

G. General
1. Install at the bottom of embankment slopes less than 10’ high to divert runoff from sheet flow and intercept some of the sediment in the sheet flow.
2. Install as ditch checks in small ditches and drainage areas.
3. Install on the lower side of cleared areas to catch sediment from sheet flow.

H. Construction Requirements:
1. Bales of straw shall be utilized to control erosion, trap sediment, and divert runoff.
2. Bales must be adequately braced from behind.

3.8 SILT FENCE

I. General
1. Install along the toe of fills over 10’ in height, along the right-of-way line, parallel to drainageways or around an inlet to prevent sediment from entering the pipe system.

J. General Requirements:
1. The Contractor shall install a temporary silt fence in locations shown on the drawings, around inlets that accept flows containing silt, and other locations necessary to prevent the discharge of silt from the site.
2. Installation shall conform to the detail at the end of this section.
3. Fence construction shall be adequate to handle the stress from hydraulic and sediment loading.

K. Installation
1. Geotextile at the bottom of the fence shall be buried as indicated on the detail.
2. The trench shall backfilled and the soil compacted over the geotextile. The geotextile shall be spliced together as indicated on the detail.

L. Post Installation
1. Post spacing shall not exceed 8’ for wire support fence installation or 5’ for self-supported installations.
2. Posts shall be driven a minimum of 24” into the ground. Where rock is encountered, posts shall be installed in a manner approved by the Owner’s Representative.
3. Closer spacing, greater embedment depth and/or wider posts shall be used in low areas, soft, or swampy ground to ensure adequate resistance to applied loads.
4. When support fence is used, the mesh shall be fastened securely to the upstream side of the post.
5. The mesh shall extend into the trench a minimum of 2” and extend a maximum of 36” above the original ground surface.
6. When self-supported fence is used, the geotextile shall be securely fastened to fence posts.

M. Maintenance
1. The Contractor shall maintain the integrity of silt fences as long as they are necessary to contain sediment runoff.

2. The Contractor shall inspect all temporary silt fences immediately after each rainfall. Inspect daily during prolonged rainfall.
3. The Contractor shall immediately correct deficiencies.
4. The Contractor shall make a daily review of the location of silt fences in areas where construction activities have changed the natural contour and drainage runoff to ensure that the silt fences are properly located for effectiveness.
5. Where a single fence is not adequate to handle the volume of silt or flows are not completely intercepted, additional silt fences shall be installed.
6. The Contractor shall remove and dispose of sediment deposits when the deposit approaches one-half the height of the fence.
7. The silt fence shall remain in place until the upstream surface is stabilized. Upon removal, the Contractor shall remove the silt fence, dispose of excess silt, and restore the disturbed area.

3.9 SEDIMENT REMOVAL

N. General

O. Sediment deposits shall be removed when:

P. The deposits reach approximately one-half the height of a ditch check, straw bale barrier or silt fence.

Q. The sediments have reduced the ponded volume of sediment basins to one-third of the original volume.

R. Requested by the Owner's Representative.

S. Sediment removed from erosion control features shall be deposited in a location where it will not erode into construction areas or watercourses.

END OF SECTION 312500

SECTION 321313 - CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

1. Cast-in-place concrete paving shall be installed by the Contractor if for all portions of the project that have been accepted by the owner to be installed as concrete pavement in lieu of asphalt paving. This section applies to exterior driving and walking surfaces depicted on the plan.

1.2 SUBMITTALS

1. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

2. Design Mixes: Submit for approval design mixes, including adjustments for variations in project conditions.

    a. Mixes to be designed in accordance with the Portland Cement Association.

    b. All exposed concrete shall be air entrained. Allowable ranges shall be as follows:

        1. ¾" to 1" aggregate size shall contain 6.0% average entrained air. The total air content range shall be between 5%-7%.

    c. All concrete shall achieve 4000 psi compressive strength in 28 days.

    d. Flint and chert to be limited to 1% maximum, by weight of the coarse aggregate, in all exposed concrete. Lignite will be limited to 0.07% by weight of the fine aggregate in all exposed concrete.

    e. Sand shall be from local sources meeting ASTM C-33 Size 67 for concrete.

    f. The use of calcium chloride in concrete mixes will not be permitted. Fly ash is permitted as needed to reduce the total amount of portland cement, which would otherwise be used, by not more than 30 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

        a. Fly Ash: 15 percent.

    g. Maximum water-to-cementious materials ratio shall be .48

    h. Concrete slump shall be a maximum of 4" +/- 1" (ASTM C- 143) as delivered in the field. Contractor may use chemical admixtures to attain a maximum slump of 8" for workability. No water may be added to the concrete mix on site unless water is withheld at the batching facility. If water is withheld at the batching facility it should be reflected on the load ticket. The total amount of water in the mix shall not exceed what is noted on the approved mixed. This shall be noted in the special inspector's records.

3. Test Mix Reports: Submit test reports for approval prior to construction.

1.3 QUALITY ASSURANCE

1. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

2. Construction Tolerance: 1/8' in 10' for grade and alignment of top of forms; 1/4' in 10' for vertical face on longitudinal axis.

3. Testing: Independent testing agency shall be obtained by the contractor. Testing requirements shall be as follows:

    a. An ACI certified Grade I field technician shall perform the testing

    b. Test shall be performed for strength, air entrainment, temperature, and slump. Strength tests will require 4 cylinders (1 broken @ 7 days; 2 broken @ 28 days, 1 spare). Test results should be sent to the contractor, architect, and owner's representative.

    c. Concrete will be tested at the minimum rate of one test for the first 25 cubic yards placed each day, and one test for each additional 50 cubic yards placed thereafter.

    d. Test data from concrete cylinder breaks will be evaluated using procedures of ACI 214.

PART 2 PRODUCTS

2.1 MATERIALS

1. Concrete Paving Materials:
    1. Accessories:
        a. Wire Mesh Reinforcement: Welded plain steel wire fabric, ASTM A 185.
        b. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.
        c. Fabricated Bar Mats: Steel bar or rod mats, ASTM A 184, using ASTM A 615, Grade 60 steel bars.
        d. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60.
        e. Hook Bolts: ASTM A 307, Grade A threaded bolts.
        f. Liquid-Membrane Forming and Sealing Curing Compound: ASTM C 309, Type I, Class A.
        g. Bonding Compound: Polyvinyl acetate or acrylic base.
        h. Color Pigment: ASTM C 979.
        i. Marking Paint: FS TT-P-1952 white for parking stripes, and blue at handicap areas.
        j. Epoxy Adhesive: ASTM C 881.

PART 3 EXECUTION

3.1 INSTALLATION

1. Comply with ACI 301 for measuring, mixing, transporting, and placing concrete.

2. Proof roll subbase and check for unstable areas. Report unsatisfactory conditions in writing to the owners representative.

3. Comply with concrete section for concrete mix, testing placement, joints, tolerances, curing, repairs and protection.

4. Dispose of over-mixed concrete off-site in a legal manner.

5. Protect concrete paving until weight of a person will not leave any impression. Remove and replace concrete paving, which shows impressions or other defects. Skim coating defects is not acceptable.

6. Contraction joints shall be tooled during finishing or sawed within 18 hours of concrete placement. If the joint edge ravels, do not proceed until concrete has sufficient cure time to saw without damage.

    a. Contraction joints shall have a minimum depth of ¼ of the pavement thickness and a minimum width of 1/8”

    b. Transverse contraction joints will be provided at a maximum of 2.5 times the pavement thickness (in inches) in feet for street pavements and 2.0 times for all other pavements.

    c. Longintudinal joints shall have a maximum separation of 12 feet for streets and drives and 9 feet for sidewalks.

    d. The ratio of slab width to length should not exceed 1.67 for street pavements and 1.25 for all other pavements.

    e. All joints to be sealed with bituminous joint sealant.

7. Sweep and clean surface to eliminate loose material and dust and apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils

3.2 FIELD QUALITY CONTROL

1. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.

2. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:
    A. Testing Frequency: Obtain at least one composite sample for each 50 cuyd or fraction thereof of each concrete mixture placed each day.
        i. When frequency of testing will provide fewer than 5 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.
    B. Slump: ASTM C143; 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.
    C. Air Content: ASTM C231, pressure method; one test for each composite sample, but not less than one test for each day’s pour of each concrete mixture.
    D. Concrete Temperature: ASTM C1064; one test hourly when air temperatures is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
    E. Compression Test Specimens: ASTM C31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
    F. Compressive Strength Tests: ASTM C; test one specimen at seven days; two specimens at 28 days and hold one specimen in reserve for future testing, if needed.

i. A compressive strength test shall be the average compressive strength from two specimens obtained from the same composite sample and tested at 28 days.

3. Strength of each concrete mixture will be satisfactory if 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.

4. Test results shall be reported in writing to the Owner, 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 an 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-day and 28-day tests.

5. Nondestructive Testing: Sonoscope or other nondestructive device may be permitted by Owner but will not be used as sole basis for approval or rejection of concrete.

6. 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 the Owner.

7. Concrete paving will be considered defective if it does not pass tests and inspections.

8. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work within specified requirements.

9. Prepare test and inspection reports.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.

B. Related Sections include the following:
   1. Division 32 Section “Concrete Paving” for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealed product indicated.

B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer’s written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet or covered with frost.

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, 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.

2.3 COLD-APPLIED JOINT SEALANTS (SIDEWALKS)

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
   1. Products:
      a. Crafco Inc.: RoadSaver Silicone
      b. Dow Corning Corporation; 888
   2. Joint-Sealant Backer Materials
      a. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing
      b. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.4 HOT-APPLIED JOINT SEALANTS (PARKING LOTS)

A. Joint Filler. After the pavement has been properly cured, all open joints including expansion joints, construction joints, and longitudinal joints, shall be cleaned, primed with a light grade of cut-back asphalt, and poured full of an approved hot poured joint sealing compound. The joint sealing compound shall be either polymeric asphalt based (AASHTO M301, ASTM D3405) or elastomeric-type (AASHTO M282, ASTM D3406), heated and applied in strict accordance with instructions of the manufacturer. Joints must be thoroughly clean and dry immediately before seal is poured and sealing compound shall be poured so that the joint is filled to the level of the adjacent concrete surfaces.

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.
   1. 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.

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 backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of backer materials.
   2. Do not stretch, twist, puncture, or tear backer materials.
   3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backing are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses provided for each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealants from surfaces adjacent to joint.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 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 and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 321373

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY OF WORK INCLUDED

A. Cleaning and preparation of surfaces to receive paint striping with a high pressure water sprayer. Only the surfaces for striping require cleaning.

B. Painting in parking lines, safety zones, handicap zones, loading zones, no parking zones in parking lots indicated on drawings.

C. Protecting adjacent surfaces from paint drips, spatters and overspray

D. Protect wet paint from vehicular and pedestrian traffic.

PART 2 PRODUCTS

2.1 PAINT

A. Paint for parking lot striping shall be chlorinated rubber conforming to TT-P11SF epoxy pavement marking material without glass beads.

B. Paint type must be compatible with the surfaces to be painted

2.2 COLORS

A. Paint shall be applied per the following color code: White for standard parking space lines and sidewalk crossings. Blue for handicap parking stall and symbols and associated cross-hatched areas

2.3 MATERIALS

A. Materials shall include standard commercial grade masking materials, scrapers, cleaning solvents, and other materials required for the work.

B. Use materials specified by manufacturer’s direction label on container.

2.4 DELIVERY AND STORAGE

A. Deliver materials to the site in original containers with seals unbroken and labels intact.

B. Protect all paint from freezing.

C. Do not allow paint to settle, cake, or thicken in the container. Readily stir with a paddle to a smooth consistency.

D. Paint shall arrive on the job color-mixed except for tinting of undercoats and possible thinning.

PART 3 EXECUTION

3.1 PROTECTION

A. Prior to beginning cleaning or painting operations, contractor shall protect all items or surfaces not included in area to be painted. Protect vehicles, equipment, structures, or other items from paint spatters, over spray, or damage.

B. Contractor shall provide barricades and any signage needed to protect all painted areas from pedestrian and vehicular traffic until achieving sufficient drying time.

3.2 INSTALLATION REQUIREMENTS

A. Perform painting as soon as feasible and practical after the finishing of the pavement or as directed by the owners representative.

B. Adequate lighting shall be available at the time of painting.

C. Examine all surfaces to receive paint to make sure there are no defects in the surface to be striped. Do not paint over rust, scale, grease, oil, fuel, dust, wet pavement, or other conditions detrimental to paint adhesion. Remove grease, oil, or fuel on any surface before painting. Correct all surface defects before painting.

D. Contractor shall examine areas to be painted. Notify the owners representative in writing of conditions that might delay timely completion of the work.

3.3 WEATHER CONDITIONS

A. Painting shall not be performed when the ambient temperature is less than 55 degrees Fahrenheit, or while the surface is damp.

B. The surface must be five degrees or more above the dew point temperature during painting operations and while paint is drying.

3.4 APPLICATION

A. Areas to be painted shall receive one coat of paint not less than 25 mils thickness wet per MODOT 620.9 through 620.9.3.4.2. In locations requiring multiple coats, prior coat shall be dry to manufacturer's recommendations before applying the next coat.

B. Finished work shall be uniform, of approved color, free of runs, drips, defective brushing, spraying, and clogging. Parking lines and symbols shall be neat and well defined. Only skilled applicators shall apply paint. Owners representative shall approve application techniques.

3.5 QUALITY CONTROL

A. Remove paint splatter from adjacent areas or areas not designated to receive paint.

B. Contractor shall repair or touch up any surfaces if exposed to vehicular and pedestrian traffic, to the satisfaction of the owner's representative, at no additional cost to the owner.

C. When color, dirt, stains, existing paint, etc., show through the final coat, repaint the surface until the film is uniform in finish, coverage, color, and appearance

END OF SECTION 321723

SECTION 329200 - TURFS & GRASSES

PART 1 - GENERAL

1.1 SCOPE

A. The Landscape Contractor shall provide all labor, equipment, materials and services necessary to furnish and install seeding as specified herein, as indicated on the drawings and to all areas disturbed by this project for seeding.

B. Work shall include, but is not limited to, the following:
   1. Soil Preparation
   2. Seeding
   3. Maintenance Period

C. Related work specified elsewhere:
   1. Section 31 1000 Site Clearing
   2. Section 31 2000 Earth Moving

D. Guarantee
   1. Seeding
      a. After final grading the Contractor shall guarantee a satisfactory stand of grass (10lbs/1,000 s.f.), and shall repair and re-seed any wash-outs or areas not covered with grass, at the end of sixty (60) days at no additional cost to the Owner.

      b. The Contractor shall be responsible for the removal of weeds, tall grasses, rocks, etc. before seeding is completed.

PART 2 - MATERIALS

2.1 FERTILIZER

A. 18-6-12 slow release fertilizer

2.2 MATERIALS FOR SEEDING

A. Agricultural limestone at seed manufacturer's recommended rate based on soils testing.

B. Commercial fertilizer 23-7-7 or 24-6-6 analysis, urea based, slow release type nitrogen, used at seed manufacturer's recommended based on soils testing.

C. Seed for "Seed and Straw" area shall be a mix of 80% K-31 Tall Fescue and 20% "Gulf" Annual or "Linn" Perennial Ryegrass. Seed at a rate of 10 lbs. per 1,000 s.f.

D. Other specific commercial pre-mixed seed mixes that have a proven track record of success for the purpose and location will be considered when accompanied by a Request for Substitution.

PART 3 - EXECUTION

3.1 SEEDING

A. Seeding operations shall be performed when conditions are favorable to establish a strong stand of grass. Seeding shall take place between March 1 and September 30. Acceptance of permanent seeding will be made when seeded disturbed areas meet vegetated establishment of 80%. Inspection for acceptance will be made within 60 days after seeding, excluding seeding dates that fall between September 30 and March 1. Seeding that occurs between September 30 and March 1 will be inspected no earlier than May 1.

B. Furnish all labor, materials, equipment and services necessary to seed all unpaved areas of the project site and at all areas disturbed by this project.

C. Cultivate areas to be seeded by disking to a depth of four inches (4”). Area shall be free from material such as hard clods, stiff clay, hardpad, partially disintegrated stone, pebbles larger than one inch (1”), roots, sticks, construction debris and other extraneous materials. Topsoil shall be a fertile, friable and loamy soil of uniform quality without the admixture of subsoil material. Top soil shall be relatively free from grass, roots, weeds and other objectionable plant material or vegetative debris undesirable or harmful to plant life or which will prevent the formation of a suitable seedbed.

D. Apply lime and fertilizer at the rates designated and mix thoroughly into the soil to depth of four inches (4”).

E. Areas to be seeded shall then be fine graded to a smooth even surface with a loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet the finish grades.

F. Sow seed using a mechanical spreader or seeding machine calibrated to distribute the seed at the rate designated. Do not seed when wind velocities exceed five (5) miles per hour. Distribute seed evenly over the entire area by sowing equally in two (2) directions at right angles to each other.

G. Rake seed lightly into the top ¼” of soil, roll lightly and water thoroughly with a fine spray.

H. Protect newly seeded areas against erosion by spreading straw mulch after completion of the seeding operations. Spread straw mulch uniformly to form a continuous blanket not less than 1½" inch loose thickness. Sloped areas greater than 1:6 shall be protected against erosion by installing erosion control netting as approved by the Architect. Vegetative mulch shall be prairie hay or straw from oats, rye, wheat or barley. Prairie hay shall consist of any combination of the following plants: Big Bluestem, Little Bluestem, Indiangrass, Sideoats Grama or native wildflowers. Mulch shall be free of prohibited weed seed as stated in the Missouri Seed Law and shall be relatively free of all other noxious and undesirable seed. The mulch shall be clean and bright, relative free of foreign material and shall be dry enough to spread properly. Vegetated mulch shall be applied at a minimum rate of 2.5 tons per acre. All mulch shall be distributed evenly within 24 hours following the seeding operation. Following the mulching operation, precautions shall be taken to prohibit foot or vehicular traffic over the mulched area. Any much that is displaced shall be replaced at once, but only after the work preceding the mulching which was damaged as a result of the displacement has been repaired to the satisfaction of the engineer. The contractor may use erosion control blankets in lieu of mulch. No additional payment will be made for erosion control blankets used in lieu of mulch at the contractor’s option.

I. Anchor straw mulch by spraying with an asphalt emulsion at the rate of 10 to 13 gallons per thousand square feet.

J. The contractor may use hydroseeding in lieu of mechanical seeding. If hydroseeding is used, mix specified seed, fertilizer and pulverized mulch in water using equipment specifically designed for hydroseed applications. Mix into a uniformly blended, homogeneous slurry. Apply slurry uniformly to all areas requiring seeding at a rate of application required to obtain the specified seed sowing rate.

K. Maintain seeded lawn areas by watering, fertilizing, weeding, mowing, trimming and other operations such as rolling, regarding and replanting as required to establish a smooth acceptable lawn, free of eroded or bare areas.

L. All seeded lawn areas shall be maintained as outlined above for not less than sixty (60) days after the dates of Substantial Completion. If seeded in the fall and not given a full sixty (60) days of maintenance, or if not considered acceptable at that time, maintenance shall continue the following spring for up to an additional sixty (60) days.

3.2 CLEAN UP

A. Remove all surplus materials and debris from the project site.

B. Finally water all seeded areas before leaving site.

END OF SECTION 329200

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Special fittings for expansion and deflection.
2. Cleanouts.
3. Drains.
4. Precast concrete, cast-in-place concrete, or plastic junction boxes.

1.3 DEFINITIONS

A. HDPE: High density polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Special pipe fittings.
2. Drains.
3. Channel drainage systems.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers.
2. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, and design calculations.

C. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 STEEL PIPE AND FITTINGS

A. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.

1. Special-Joint Bands: Corrugated steel with O-ring seals.
2. Standard-Joint Bands: Corrugated steel.
3. Coating: Aluminum.

2.3 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Pipe and Fittings: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness pipe with ASTM D 3034, SDR 35, socket-type fittings for solvent-cemented joints.

B. PVC Sewer Pipe and Fittings, NPS 15 (DN 375) and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

C. PVC Sewer Pipe and Fittings, NPS 18 (DN 450) and Larger: ASTM F 679, T-[1] [2] wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

D. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.4 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M), with bell-and-spigot or groove and tongue ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets.
   1. Class III, Wall C.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

   1. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
   2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

2.6 CLEANOUTS

A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 MANHOLE STRUCTURES

A. Standard Precast Concrete Manhole structures: ASTM C 478 (ASTM C 478M), pre-cast, reinforced concrete, of depth indicated, with provision for sealant joints.

   1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.
   2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
   3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
   4. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
   5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
   6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
   7. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
   8. Steps: deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into side-

walls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.

9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
10. Protective Coating: Plant-applied, coal-tar 10-mil (0.26-mm) minimum thickness applied to exterior surfaces.
11. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.
    b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to all surfaces, unless otherwise indicated.

B. Designed Precast Concrete Manholes: ASTM C 913; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.

1. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole, as required to prevent flotation.
2. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
4. Steps: 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.
5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
6. Protective Coating: Plant-applied, coal-tar; 10-mil (0.26-mm) minimum thickness applied to exterior surfaces.
7. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.
    b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to all surfaces, unless otherwise indicated.

C. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Ballast: Increase thickness of concrete, as required to prevent flotation.
2. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
3. Steps: deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into side-

walls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches.

4. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
5. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.
    b. Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to all surfaces, unless otherwise indicated.

2.8 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

2.9 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints as shown on plan.

B. Cast-in-Place Concrete, Catch Basins: Construct of reinforced concrete; designed according to ASTM C 890 for structural loading; of depth, shape, dimensions, and appurtenances indicated as shown on plan.

1. Bottom, Walls, and Top: Reinforced concrete.
2. Channels and Benches: Concrete.
3. Steps: deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into side-

walls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 36 inches.

C. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings.

2.10 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy-duty frames and grates according to utility standards.

E. Combination Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

F. Frames and Grates: Dimensions, opening pattern, free area, and other attributes indicated.

2.11 STORMWATER DETENTION STRUCTURES

A. Cast-in-Place Concrete, Stormwater Detention Structures: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Ballast: Increase thickness of concrete, as required to prevent flotation.
2. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch (150- to 229-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and cover.
3. Steps: deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of structure to finished grade is less than 36 inches.

B. Manhole Frames and Covers: ASTM A 536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch (610-mm) ID by 7- to 9-inch (178- to 229-mm) riser with 4-inch (102-mm) minimum width flange, and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering "STORM SEWER" cast into cover.

2.12 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."

1. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).
2. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
3. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).

C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size, graded stone.

D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2700-kg) average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 2000 Section "Earthwork."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Unshielded flexible couplings for same or minor difference OD pipes.
b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping: Use pipe materials as shown on the Site Development Plans.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicat-

ed, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install corrugated steel piping according to ASTM A 798/A 798M.
4. Install corrugated aluminum piping according to ASTM B 788/B 788M.
5. Install HDPE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.4 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 2 Section "Piped Utilities - Basic Materials and Methods." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:
1. Join corrugated steel sewer piping according to ASTM A 798/A 798M.
2. Join corrugated aluminum sewer piping according to ASTM B 788/B 788M.
3. Join corrugated HDPE piping according to CPPA 100 and the following:

a. Use silttight couplings for Type 1, silttight joints.
b. Use soiltight couplings for Type 2, soiltight joints.

4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
5. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.

6. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
7. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections according to ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.6 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 STORMWATER INLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.8 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.9 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 15 Section "Storm Drainage Piping."

3.10 PAINTING

A. Clean and prepare concrete manhole surfaces for field painting. Remove loose efflorescence, chalk, dust, grease, oils, and release agents. Roughen surface as required

to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:

1. Cast-in-Place-Concrete Manholes: All exterior, except bottom.
2. Precast Concrete Manholes: All exterior.

B. Prepare ferrous frame and cover surfaces according to SSPC-PA 1 and paint according to SSPC-PA 1 and SSPC-Paint 16. Do not paint surfaces with foundry-applied, corrosion-resistant coating.

3.11 IDENTIFICATION

A. Materials and their installation are specified in division 2 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
b. Option: Test plastic piping according to ASTM F 1417.
c. Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.13 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 334100

APPENDIX A

ENVIRONMENTAL & DEMOLITION CONTRACTORS
P.O. Box 105287, Jefferson City, MO 65110-5287
573.896.0222 ■ www.arsi-mo.com
Service-Disabled Veteran Enterprise (SDVE)

December 11, 2023

SOA Architecture
Attn: Jan Hedrick
2801 Woodard Drive, Suite 103
Columbia, MO 65202

RE: Pre-Renovation Survey Asbestos Inspection, Mexico Readiness Center, 917 West Curtis Street, Mexico, MO. ARSI Job # 2399-39.

Jan:

At your request, on 12/06/2023 ARSI conducted a pre-renovation survey of Mexico Readiness Center, 917 West Curtis Street, Mexico, MO which is scheduled for renovation. This inspection was performed in order to comply with the EPA and MDNR NESHAP regulations, which require a "thorough" asbestos inspection prior to renovation or demolition, conducted by accredited inspector. Robert Anderson, MDNR Asbestos Inspector #7118050823MOIR1531 and Matthew Roark, MDNR Asbestos Inspector # 7118063023MOIR6862 performed the inspection.

Three buildings were inspected at the Mexico Readiness Center, 917 West Curtis Street, Mexico, MO. The first one inspected was the Drill Hall. The Drill Hall has a stucco exterior. The interior is made up of classrooms and offices. The second building inspected was the Cold Storage Building. The Cold Storage Building is a metal building with a concrete floor. The third building inspected was the Old FMS Building. The Old FMS Building has a small office area and a large garage.

Twenty-nine (29) bulk samples (which were separated into forty-three (43) distinct components) of suspected ACM were collected. All of the samples were sent to SanAir Technologies Laboratory, Powhatan, Virginia, an independent NVLAP-accredited laboratory, for analysis by polarized light microscopy.

(10) sample tested positive for asbestos, namely:

	Sample Number	Description	Category	Condition	Quantities
1	1664	Safe Door	Friable	Good	1 ea.
2	1675	12x12 floor tile under Carpet (Office 326, 157, 158, 219)	Category I – Non-Friable	Good	860 ft²
3	1675	Associated Mastic Adhesive under VAT (Office 326, 157, 158, 219)			
4	1676	Associated Mastic Adhesive under VCT (Office 405)	Category I – Non-Friable	Good	858 ft²
5	1678	Associated Mastic Adhesive under VCT (Office 453)			
6	1679	9x9 floor tile (Office 453 Mechanical Room)	Category I – Non-Friable	Good	4 ft²
7	1679	Associated Mastic Adhesive under VAT (Office 453 Mechanical Room)			
8	1681	12x12 floor tile (Kitchen)	Category I – Non-Friable	Good	177 ft²
9	1681	Associated Mastic Adhesive under VAT (Kitchen)			
10	1683	Pipe Insulation (Abandoned Water Line)	Friable	Good	150 LF

All of the other samples tested either negative for asbestos, or less than 1% asbestos, which is below the EPA/DNR regulatory threshold/definition of an asbestos-containing material.

CLARIFICATIONS & LIMITATION OF INSPECTION

This inspection covered only those areas in the building that were exposed and /or physically accessible to the inspectors. Although reasonable effort was made to survey accessible suspect materials, additional suspect but not-sampled materials could be located in walls, in voids, or other concealed areas. This was a non-destructive inspection.

Below is a list of items not tested by this inspection:

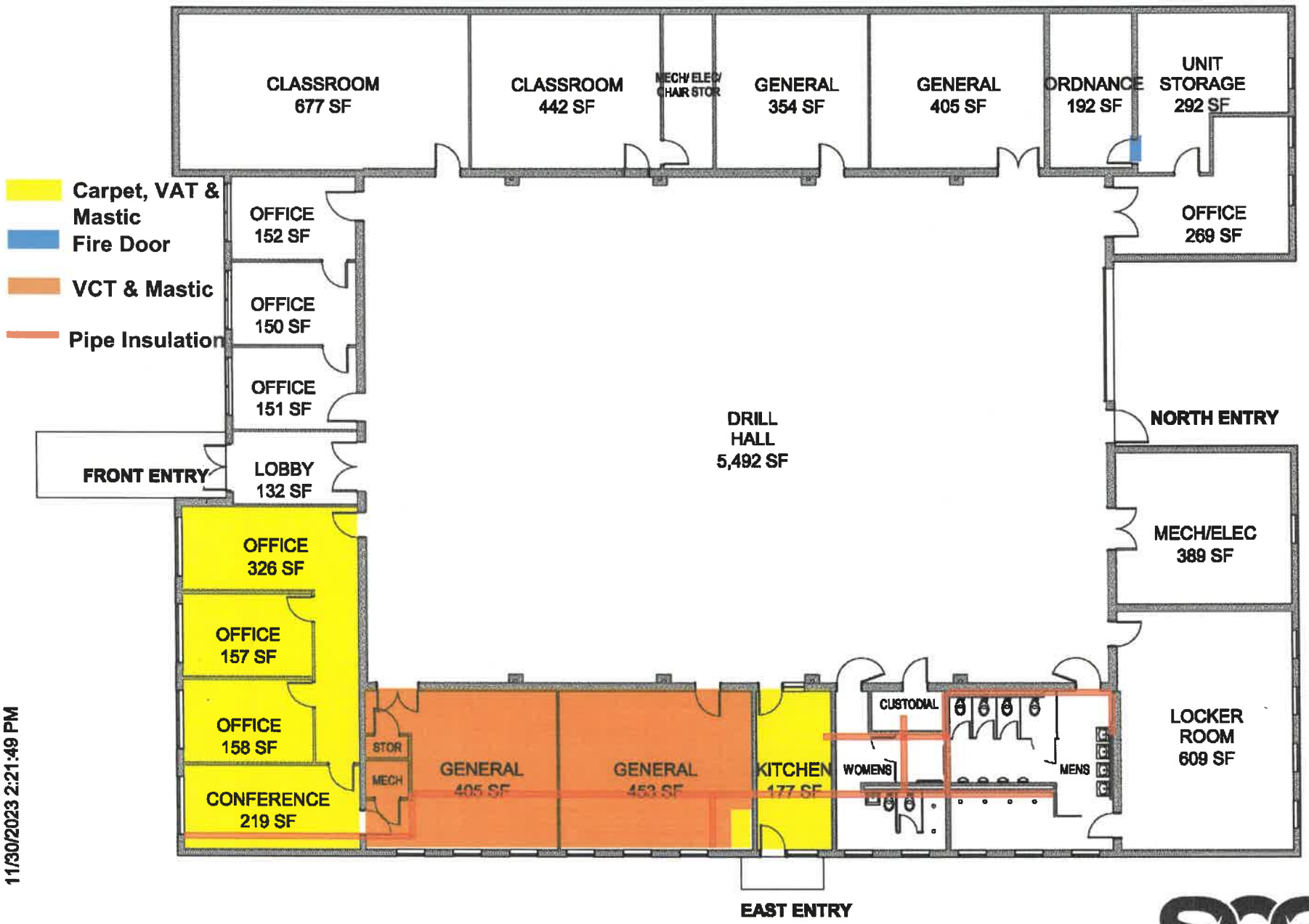
- Electrical wiring insulation
- Waterproofing materials
- Interior Boiler Insulations or Gasket Materials
- Lead-Based Paint
- Fluorescent Light Bulbs
- PCB Ballast
- Any other hazardous materials

Enclosed with this document are copies of the laboratory analysis report, chain of custody letter, site work sheets, photographs of portions of the asbestos-containing materials identified by the inspection, and MDNR certification of inspectors performing the inspection. Additional information regarding DNR and EPA asbestos regulations can be found at the following website: www.dnr.mo.gov/pubs/pub2157.htm. Thank you for the opportunity of serving you in this capacity. Don't hesitate to call if you have any questions.

Sincerely,

ARSI, Inc.

Matthew Roark
General Manager



11/30/2023 2:21:49 PM

State of Missouri Readiness Center
SOA #23059
State Project #T2318-01

Mexico Readiness Center Floor Plan

11/30/23 Address: 917 West Curtis Street
Mexico, Missouri 65265

Scale: 1/16" = 1'-0"

SOA ARCHITECTURE

MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Michael L. Parson
Governor

Dru Buntin

CERTIFICATION NUMBER:
7118063023MOIR6862

THIS CERTIFIES
Matthew A Roark
HAS COMPLETED THE CERTIFICATION
REQUIREMENTS FOR
Inspector

APPROVED: 07/06/2023
EXPIRES: 07/06/2024

TRAINING DATE: 06/30/2023

Director of Air Pollution Control Program

July 6, 2023

Matthew A Roark
266 City View Ln
Bonnots Mill, MO 65016

RE: **Missouri Asbestos Occupation Certification Card**

Enclosed is your certification card for Asbestos Inspector, as issued by the Asbestos Unit of the Missouri Department of Natural Resources' Air Pollution Control Program.

Missouri Certification Number: 7118063023MOIR6862
Course Training Date: June 30, 2023
Missouri Certification Approval Date: July 06, 2023
Missouri Certification Expiration Date: July 06, 2024

Note:

- All Missouri-certified asbestos personnel must comply with the following statutes and regulations:
  - Sections 643.225 to 643.250, RSMo;
  - 10 CSR 10-6.241 *Asbestos Projects-Registration, Abatement, Notification, Inspection, Demolition, and Performance Requirements; and*
  - 10 CSR 10-6.250 *Asbestos Projects-Certification, Accreditation and Business Exemption Requirements.*
- To keep your occupation certification up-to-date, you must complete an annual refresher course and submit a renewal application each year.
- In order to be eligible to renew your certification, you must successfully complete a refresher course with a Missouri-accredited training provider within 12 months of the expiration date of your current training certificate. If you exceed this grace period, you will be required to retake a Missouri-accredited initial course in order to be eligible for Missouri certification.

To obtain a copy of the certification renewal application, or review regulations and requirements, please visit our website at http://dnr.mo.gov/env/apcp/asbestos/index.htm.

If you have any questions please call the Air Pollution Control Program at 573-751-4817.

AIR POLLUTION CONTROL PROGRAM

Director of Air Pollution Control Program

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Michael L. Parson
Governor

CERTIFICATION NUMBER:
7118050823MOIR1531

THIS CERTIFIES
Robert A Anderson
HAS COMPLETED THE CERTIFICATION REQUIREMENTS FOR
Inspector.

APPROVED: **05/15/2023**
EXPIRES: **05/15/2024**
TRAINING DATE: **05/08/2023**

Director of Air Pollution Control Program

May 12, 2023

Robert A Anderson
711 W Chestnut
Fulton, MO 65251

RE: **Missouri Asbestos Occupation Certification Card**

Enclosed is your certification card for Asbestos Inspector, as issued by the Asbestos Unit of the Missouri Department of Natural Resources' Air Pollution Control Program.

Missouri Certification Number: 7118050823MOIR1531
Course Training Date: May 08, 2023
Missouri Certification Approval Date: May 15, 2023
Missouri Certification Expiration Date: May 15, 2024

Note:

- All Missouri-certified asbestos personnel must comply with the following statutes and regulations:
  - Sections 643.225 to 643.250, RSMo;
  - 10 CSR 10-6.241 *Asbestos Projects-Registration, Abatement, Notification, Inspection, Demolition, and Performance Requirements; and*
  - 10 CSR 10-6.250 *Asbestos Projects-Certification, Accreditation and Business Exemption Requirements.*
- To keep your occupation certification up-to-date, you must complete an annual refresher course and submit a renewal application each year.
- In order to be eligible to renew your certification, you must successfully complete a refresher course with a Missouri-accredited training provider within 12 months of the expiration date of your current training certificate. If you exceed this grace period, you will be required to retake a Missouri-accredited initial course in order to be eligible for Missouri certification.

To obtain a copy of the certification renewal application, or review regulations and requirements, please visit our website at http://dnr.mo.gov/env/apcp/asbestos/index.htm.

If you have any questions please call the Air Pollution Control Program at 573-751-4817.

AIR POLLUTION CONTROL PROGRAM

Director of Air Pollution Control Program

SanAir Technologies Laboratory

The Identification Specialists

Analysis Report prepared for ARSI, Inc.

Report Date: 12/11/2023

Project Name: Mexico Readiness Center

Project #: 2399-39

SanAir ID#: 23067381

NVLAP TESTING

NVLAP LAB CODE 200870-0

10501 Trade Court | North Chesterfield, Virginia 23236
888.895.1177 | 804.897.1177 | fax: 804.897.0070 | IAQ@SanAir.com | SanAir.com

SanAir Technologies Laboratory

SanAir ID Number
23067381
FINAL REPORT
12/11/2023 10:47:00 AM

Name: ARSI, Inc.
Address: PO Box 105287
Jefferson City, MO 65110
Phone: 573-896-0222

Project Number: 2399-39
P.O. Number: 117
Project Name: Mexico Readiness Center
Collected Date: 12/6/2023
Received Date: 12/8/2023 11:20:00 AM

Dear Bob Anderson,

We at SanAir would like to thank you for the work you recently submitted. The 29 sample(s) were received on Friday, December 08, 2023 via UPS. The final report(s) is enclosed for the following sample(s): 1663, 1664, 1665, 1666, 1667, 1668, 1669, 1670, 1671, 1672, 1673, 1674, 1675, 1676, 1677, 1678, 1679, 1680, 1681, 1682, 1683, 1684, 1685, 1686, 1687, 1688, 1689, 1690, 1691.

These results only pertain to this job and should not be used in the interpretation of any other job. This report is only complete in its entirety. Refer to the listing below of the pages included in a complete final report.

Sincerely,

Sandra Sobrino

Sandra Sobrino
Asbestos & Materials Laboratory Manager
SanAir Technologies Laboratory

Final Report Includes:
- Cover Letter
- Analysis Pages
- Disclaimers and Additional Information

Sample conditions:
- 29 samples in Good condition.

SanAir Technologies Laboratory

SanAir ID Number
23067381
FINAL REPORT
12/11/2023 10:47:00 AM

Name: ARSI, Inc.
Address: PO Box 105287
Jefferson City, MO 65110
Phone: 573-896-0222

Project Number: 2399-39
P.O. Number: 117
Project Name: Mexico Readiness Center
Collected Date: 12/6/2023
Received Date: 12/8/2023 11:20:00 AM

Analyst: Childress, Susan

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	Components % Fibrous	% Non-fibrous	Asbestos Fibers
1663 / 23067381-001 2x4 Ceiling Tiles (Unit Storage)	White Fibrous Homogeneous	55% Cellulose 15% Glass	30% Other	None Detected
1664 / 23067381-002 Safe Door Insulation	White Fibrous Homogeneous		40% Other	60% Chrysotile
1665 / 23067381-003 Adhesive From 1x1 Ceiling Tile (General 405)	Brown Non-Fibrous Homogeneous		100% Other	None Detected
1666 / 23067381-004 Adhesive From 1x1 Ceiling Tile (General 354)	Brown Non-Fibrous Homogeneous		100% Other	None Detected
1667 / 23067381-005 2x4 Ceiling Tile (Classroom 442)	White Fibrous Homogeneous	45% Cellulose 15% Glass	40% Other	None Detected
1668 / 23067381-006 1x1 Ceiling Tile (Classroom 442)	White Fibrous Homogeneous	80% Cellulose	20% Other	None Detected
1669 / 23067381-007 Cove Base (Office 152), Cove Base	Grey Non-Fibrous Homogeneous		100% Other	None Detected
1669 / 23067381-007 Cove Base (Office 152), Mastic	White Non-Fibrous Homogeneous		100% Other	None Detected
1670 / 23067381-008 2x2 Ceiling Tile (Office 152)	White Fibrous Homogeneous	55% Cellulose 10% Glass	35% Other	None Detected
1671 / 23067381-009 Drywall (Ceiling Office 152)	White Non-Fibrous Homogeneous	6% Cellulose	94% Other	None Detected

Analyst: Susan P. Childress Approved Signatory: Ronald A. Wyatt

Analysis Date: 12/11/2023 Date: 12/11/2023

SanAir Technologies Laboratory

SanAir ID Number
23067381
FINAL REPORT
12/11/2023 10:47:00 AM

Name: ARSI, Inc.
Address: PO Box 105287
Jefferson City, MO 65110
Phone: 573-896-0222

Project Number: 2399-39
P.O. Number: 117
Project Name: Mexico Readiness Center
Collected Date: 12/6/2023
Received Date: 12/8/2023 11:20:00 AM

Analyst: Childress, Susan

Asbestos Bulk PLM EPA 600/R-93/116

	Stereoscopic	Components		
SanAir ID / Description	Appearance	% Fibrous	% Non-fibrous	Asbestos Fibers
1672 / 23067381-010 Window Caulk (Interior)	Black Non-Fibrous Homogeneous		100% Other	None Detected
1673 / 23067381-011 12x12 Floor Tile (Lobby), Floor Tile	Grey Non-Fibrous Homogeneous		100% Other	None Detected
1673 / 23067381-011 12x12 Floor Tile (Lobby), Mastic	Black Non-Fibrous Homogeneous		100% Other	None Detected
1674 / 23067381-012 Cove Base (Lobby), Cove Base	Grey Non-Fibrous Homogeneous		100% Other	None Detected
1674 / 23067381-012 Cove Base (Lobby), Mastic	White Non-Fibrous Homogeneous		100% Other	None Detected
1675 / 23067381-013 12x12 Floor Tile (Office 326, 157, 158, 219), Floor Tile	Beige Non-Fibrous Homogeneous		98% Other	2% Chrysotile
1675 / 23067381-013 12x12 Floor Tile (Office 326, 157, 158, 219), Mastic	Various Non-Fibrous Heterogeneous		97% Other	3% Chrysotile
1676 / 23067381-014 12x12 Floor Tile (General 405), Floor Tile	Brown Non-Fibrous Homogeneous		100% Other	None Detected
1676 / 23067381-014 12x12 Floor Tile (General 405), Mastic	Black Non-Fibrous Homogeneous		98% Other	2% Chrysotile
1677 / 23067381-015 Pipe Insulation (Office 158), Insulation	Yellow Fibrous Homogeneous	98% Glass	2% Other	None Detected

Analyst: Susan P. Childress Approved Signatory:

Analysis Date: 12/11/2023 Date: 12/11/2023

SanAir Technologies Laboratory

SanAir ID Number
23067381
FINAL REPORT
12/11/2023 10:47:00 AM

Name: ARSI, Inc.
Address: PO Box 105287
Jefferson City, MO 65110
Phone: 573-896-0222

Project Number: 2399-39
P.O. Number: 117
Project Name: Mexico Readiness Center
Collected Date: 12/6/2023
Received Date: 12/8/2023 11:20:00 AM

Analyst: Childress, Susan

Asbestos Bulk PLM EPA 600/R-93/116

	Stereoscopic	Components		
SanAir ID / Description	Appearance	% Fibrous	% Non-fibrous	Asbestos Fibers
1677 / 23067381-015 Pipe Insulation (Office 158), Cover	Silver Non-Fibrous Homogeneous	30% Cellulose 5% Glass	65% Other	None Detected
1678 / 23067381-016 12x12 Floor Tile (General 453), Floor Tile	Brown Non-Fibrous Homogeneous		100% Other	None Detected
1678 / 23067381-016 12x12 Floor Tile (General 453), Mastic	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
1679 / 23067381-017 9x9 Floor Tile (General 453 Furnace Room), Floor Tile	Brown Non-Fibrous Homogeneous		94% Other	6% Chrysotile
1679 / 23067381-017 9x9 Floor Tile (General 453 Furnace Room), Mastic	Black Non-Fibrous Homogeneous		96% Other	4% Chrysotile
1680 / 23067381-018 Cove Base (General 453), Cove Base	Brown Non-Fibrous Homogeneous		100% Other	None Detected
1680 / 23067381-018 Cove Base (General 453), Mastic	Brown Non-Fibrous Homogeneous		100% Other	None Detected
1681 / 23067381-019 12x12 Floor Tile (Kitchen), Floor Tile	Beige Non-Fibrous Homogeneous		98% Other	2% Chrysotile
1681 / 23067381-019 12x12 Floor Tile (Kitchen), Mastic	Black Non-Fibrous Homogeneous		97% Other	3% Chrysotile
1681 / 23067381-019 12x12 Floor Tile (Kitchen), Mastic	Tan Non-Fibrous Homogeneous		100% Other	None Detected

Analyst: Susan P. Childress Approved Signatory:

Analysis Date: 12/11/2023 Date: 12/11/2023

SanAir Technologies Laboratory

SanAir ID Number
23067381
FINAL REPORT
12/11/2023 10:47:00 AM

Name: ARSI, Inc.
Address: PO Box 105287
Jefferson City, MO 65110
Phone: 573-896-0222

Project Number: 2399-39
P.O. Number: 117
Project Name: Mexico Readiness Center
Collected Date: 12/6/2023
Received Date: 12/8/2023 11:20:00 AM

Analyst: Childress, Susan

Asbestos Bulk PLM EPA 600/R-93/116

	Stereoscopic	Components		
SanAir ID / Description	Appearance	% Fibrous	% Non-fibrous	Asbestos Fibers
1682 / 23067381-020 Window Caulk (Interior)	Black Non-Fibrous Homogeneous		100% Other	None Detected
1683 / 23067381-021 Pipe Insulation (Abandoned Water Line)	Grey Fibrous Homogeneous		45% Other	55% Chrysotile
1684 / 23067381-022 Window Caulk (Exterior Lower)	Grey Non-Fibrous Homogeneous		100% Other	None Detected
1685 / 23067381-023 Window Caulk (Exterior Upper)	Grey Non-Fibrous Homogeneous		100% Other	None Detected
1686 / 23067381-024 Roofing Material, Foam	Yellow Non-Fibrous Homogeneous		100% Other	None Detected
1686 / 23067381-024 Roofing Material, Felt	Grey Fibrous Homogeneous	60% Cellulose	40% Other	None Detected
1687 / 23067381-025 Stucco (Exterior)	Various Non-Fibrous Heterogeneous	15% Glass	85% Other	None Detected
1688 / 23067381-026 Caulk (Vent-Cold Storage Building)	White Non-Fibrous Homogeneous		100% Other	None Detected
1689 / 23067381-027 2x4 Ceiling Tile (Old FMS Building)	White Fibrous Homogeneous	55% Cellulose 10% Glass	35% Other	None Detected
1690 / 23067381-028 12x12 Floor Tile (Old FMS Building), Floor Tile	Grey Non-Fibrous Homogeneous		100% Other	None Detected

Analyst: Susan P. Childress Approved Signatory:

Analysis Date: 12/11/2023 Date: 12/11/2023

SanAir Technologies Laboratory

SanAir ID Number
23067381
FINAL REPORT
12/11/2023 10:47:00 AM

Name: ARSI, Inc.
Address: PO Box 105287
Jefferson City, MO 65110
Phone: 573-896-0222

Project Number: 2399-39
P.O. Number: 117
Project Name: Mexico Readiness Center
Collected Date: 12/6/2023
Received Date: 12/8/2023 11:20:00 AM

Analyst: Childress, Susan

Asbestos Bulk PLM EPA 600/R-93/116

SanAir ID / Description	Stereoscopic Appearance	Components % Fibrous	Components % Non-fibrous	Asbestos Fibers
1690 / 23067381-028 12x12 Floor Tile (Old FMS Building), Mastic	Yellow Non-Fibrous Homogeneous		100% Other	None Detected
1691 / 23067381-029 Cove Base (Old FMS Building), Cove Base	Grey Non-Fibrous Homogeneous		100% Other	None Detected
1691 / 23067381-029 Cove Base (Old FMS Building), Mastic	Yellow Non-Fibrous Homogeneous		100% Other	None Detected

Analyst: Susan L. Childress   Approved Signatory: [signature]

Analysis Date: 12/11/2023   Date: 12/11/2023

Disclaimer

This report is the sole property of the client named on the SanAir Technologies Laboratory chain-of-custody (COC). Results in the report are confidential information intended only for the use by the customer listed on the COC. Neither results nor reports will be discussed with or released to any third party without our client's written permission. The final report shall not be reproduced except in full without written approval of the laboratory to assure that parts of the report are not taken out of context. This report and any information contained within shall not be edited, altered, or modified in any way by any persons or agencies receiving, viewing, distributing, or otherwise possessing a copy of this final report. The laboratory reserves the right to perform amendments to any finalized report, of which shall supersede and make obsolete any previous editions. Such changes, modifications, additions, or deletions shall be effective immediately upon notice thereof, which may be given by means including but not limited to posting on the SanAir client portal website, electronic or conventional mail, or by any other means. The information provided in this report applies only to the samples submitted and is relevant only for the date, time, and location of sampling. The accuracy of the results is dependent upon the client's sampling procedure and information provided to the laboratory by the client on the COC. SanAir assumes no responsibility for the sampling procedure and will provide evaluation reports based solely on the sample(s) in the condition in which they arrived at the laboratory and information provided by the client on the COC, such as: project number, project name, collection dates, po number, special instructions, samples collected by, sample numbers, sample identifications, sample type, selected analysis type, flow rate, total volume or area, and start stop times that may affect the validity of the results in this report. Samples were received in good condition unless otherwise noted on the report. SanAir assumes no responsibility or liability for the manner in which the results are used or interpreted. This report does not constitute nor shall not be used by the client to claim product, process, system, or person certification, approval, or endorsement by NVLAP, NIST, NELAC, AIHA LAP, LLC or any other U.S. governmental agencies and may not be accredited by every local, state, and federal regulatory agencies. Samples are held for a period of 60 days. Fibers smaller than 5 microns cannot be seen with this method due to scope limitations. For NY state samples, method EPA 600/M4-82-020 is performed.

NYELAP Disclaimer:
Polarized- light microscopy is not consistently reliable in detecting asbestos in floor covering and similar non-friable organically bound materials. Quantitative transmission electron microscopy is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos containing.

Asbestos Accreditations
National Voluntary Laboratory Accreditation Program (NVLAP) Lab Code 200870-0
City of Philadelphia Department of Public Health Air Management Services, Certification#ALL-460
Commonwealth of Pennsylvania Department of Environmental Protection Number 68-05397
California State Environmental Laboratory Accreditation Program Certificate Number 2915
Colorado Department of Public Health and Environment Registration Number AL-23143
Connecticut Department of Public Health Environmental Laboratory Registration Number PH-0105
Massachusetts Department of Labor Standards Asbestos Analytical Services License Number: AA000222
State of Maine Department of Environmental Protection License Number: LB-0075, LA-0084
New York State Department of Health Laboratory ID: 11983
State of Rhode Island Department of Health Certification No.: PCM00126, PLM00126, TEM00126
Texas Department of State Health Services License Number: 300440
Commonwealth of Virginia Department of Professional and Occupational Regulation Number: 3333000323
State of Washington Department of Ecology Laboratory ID: C989
State of West Virginia Bureau for Public Health Analytical Laboratory Number: LT000616
Vermont Department of Health License Number: Asb-Co-An-000006
Louisiana Department of Environmental Quality AI Number 212253, Certificate #05088

SanAir Technologies Laboratory

1551 Oakbridge Dr. STE B
Powhatan, VA 23139
804.897.1177 / 888.895.1177
Fax 804.897.0070
sanair.com

Asbestos Chain of Custody

Form 140, Rev 3, 8/28/19

SanAir ID Number: 23067381

Company: ARSI, Inc.	Project #: 2399-39	Collected by: Bob Anderson BA
Address: PO Box 105287	Project Name: Mexico Readiness Center	Phone #: 573-896-0222
City, St., Zip: Jefferson City, MO 65110	Date Collected: 12/06/2023	Fax #: 573-896-9389
State of Collection: Missouri Account#: 3617	P.O. Number: 117	Email: bobanderson@arsi-mo.com

Bulk

ABB	PLM EPA 600/R-93/116	✓
	Positive Stop	☐
ABEPA	PLM EPA 400 Point Count	☐
ABB1K	PLM EPA 1000 Point Count	☐
ABBEN	PLM EPA NOB**	☐
ABBCH	TEM Chatfield**	☐
ABBTM	TEM EPA NOB**	☐
ABQ	PLM Qualitative	☐

** Available on 24-hr. to 5-day TAT

Water

ABHE	EPA 100.2	☐

Air

ABA	PCM NIOSH 7400	☐
ABA-2	OSHA w/ TWA*	☐
ABTEM	TEM AHERA	☐
ABATN	TEM NIOSH 7402	☐
ABT2	TEM Level II	☐
Other:		☐

New York ELAP

ABEPA2	NY ELAP 198.1	☐
ABENY	NY ELAP 198.6 PLM NOB	☐
ABBNY	NY ELAP 198.4 TEM NOB	☐

Soil

ABSE	PLM EPA 600/R-93/116 (Qual.)	☐

Vermiculite & Soil

ABSP	PLM CARB 435 (LOD <1%)	☐
ABSP1	PLM CARB 435 (LOD 0.25%)	☐
ABSP2	PLM CARB 435 (LOD 0.1%)	☐

Dust

ABWA	TEM Wipe ASTM D-6480	☐
ABDMV	TEM Microvac ASTM D-5755	☐

Matrix	Other	
		☐

Turn Around Times				
	3 HR (4 HR TEM) ☐	6 HR (8HR TEM) ☐	12 HR ☐	1 Day ☒
	☐ 2 Days	☐ 3 Days	☐ 4 Days	☐ 5 Days

Special Instructions

Sample #	Sample Identification/Location	Volume or Area	Sample Date	Flow Rate*	Start – Stop Time*	
1663	2x4 Ceiling Tiles (unit storage)	561ft²				
1664	Safe Door Insulation					
1665	Adhesive from 1x1 Ceiling Tile (general 405)					
1666	Adhesive from 1x1 Ceiling Tile (general 354)					
1667	2x4 Ceiling Tile (classroom 442)					
1668	1x1 Ceiling Tile (classroom 442)					
1669	Cove Base (office 152)					
1670	2x2 Ceiling Tile (office 152)					
1671	Drywall (ceiling office 152)					
1672	Window Caulk (interior)					
1673	12x12 Floor Tile (lobby)	132ft²				
1674	Cove Base (lobby)					

Relinquished by	Date	Time	Received by	Date	Time
BA Bob Anderson	12/06/2023	13:00	EDR	12/08/23	11:20 a.m.

If no technician is provided, then the primary contact for your account will be selected. Unless scheduled, the turnaround time for all samples received after 3 pm EST will be logged in the next business day. Weekend or holiday work must be scheduled ahead of time and is charged at 150% of the 3hr TAT or a minimum charge of $150. A courier charge will be applied for same day and one-day turnaround times for offsite work. SanAir covers Standard Overnight FedEx shipping. Shipments billed to SanAir with a faster shipping rate will result in additional charges.

23067381 Form 140, Revision 1, 1/20/2017

Sample #	Sample Identification/Location	Volume or Area	Sample Date	Flow Rate*	Start – Stop Time*	
1675	12x12 Floor Tile (office 326,157,158,219)	860ft²				
1676	12x12 Floor Tile (general 405)	405ft²				
1677	Pipe Insulation (office 158)					
1678	12x12 Floor Tile (general 453)	453ft²				
1679	9x9 Floor Tile (general 453 furnace room)	4ft²				
1680	Cove Base (general 453)					
1681	12x12 Floor Tile (kitchen)	177ft²				
1682	Window Caulk (interior)					
1683	Pipe Insulation (abandoned water line)	tbd				
1684	Window Caulk (exterior lower)					
1685	Window Caulk (exterior upper)					
1686	Roofing Material					
1687	Stucco (exterior)					
1688	Caulk (vent-cold storage building)					
1689	2x4 Ceiling Tile (Old FMS Building)					
1690	12x12 Floor Tile (Old FMS Building)	316ft²				
1691	Cove Base (Old FMS Building)					

Special Instructions	

Relinquished by	Date	Time	Received by	Date	Time
BA Bob Anderson	12/06/2023	13:00	EDR	12/08/23	11:20 a.m.

If no technician is provided, then the primary contact for your account will be selected. Unless scheduled, the turnaround time for all samples received after 3 pm EST will be logged in the next business day. Weekend or holiday work must be scheduled ahead of time and is charged at 150% of the 3hr TAT or a minimum charge of $150. A courier charge will be applied for same day and one-day turnaround times for offsite work. SanAir covers Standard Overnight FedEx shipping. Shipments billed to SanAir with a faster shipping rate will result in additional charges.

Page 2 of 2

APPENDIX B

SCI ENGINEERING, INC.
EARTH • SCIENCE • SOLUTIONS
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

December 20, 2023

Matt Roark
ARSI, Inc.
P.O. Box 105287
Jefferson City, Missouri 65110-5287

RE: Lead-Based Paint Survey Report
Mexico Readiness Center (T2318-01)
Mexico, Missouri
SCI No. 2023-1922.27

Dear Matt Roark:

INTRODUCTION

SCI Engineering, Inc. (SCI) is pleased to submit this report summarizing lead-based paint (LBP) survey activities performed on December 4, 2023. The purpose of this survey was to determine the presence of lead-based paint within the on-site structure.

LEAD BASED PAINT SURVEY

X-Ray Fluorescence Testing (XRF)

This survey was performed using an XRF that can quickly and nondestructively determine the quantity of lead present in paint coatings on various interior and exterior components of the structures.

The United States Department of Housing and Urban Development and the Missouri Department of Natural Resources indicates that LBP is any paint, varnish, stain, or other applied coating that has 1 milligram per square centimeter (mg/cm^2) or 5,000 micrograms per gram (ug/g) by dry weight (0.5 percent by mass) or more of lead. Based upon a review of the XRF results, several of the paint systems analyzed had a lead content greater than 1.0 mg/cm^3. A summary of these LPB systems is included in Table 1 below. A complete summary of the lead testing results are included with this report as well as a field sketch depicting lead sample locations.

Table 1 - LBP XRF Results

Sample Number	Sample Location	Sample Description
33	Locker Room, Side B	Green brick wall
35	Locker Room, Side A	Green brick wall
36	Men's Bathroom, Side B	Green brick wall
37	Men's Bathroom, Side D	Green brick wall
41	Women's Bathroom, Side B	Tan brick wall

Table 1 - LBP XRF Results (continued)

Sample Number	Sample Location	Sample Description
42	Women's Bathroom, Side D	Tan brick wall
155	Exterior, Side D	Red metal pole
156	Exterior, Side D	Red metal pole
157	Exterior, Side D	Tan metal awning

CONCLUSION

As can be seen in Table 1 above, several paint coatings were identified as being LBP coatings. Based on the sample results above, the following components are homogenous and should be considered LBP:

- Green brick walls in the locker room and bathrooms;
- Tan brick walls in the women's bathroom;
- Red metal poles on the exterior; and
- Tan metal awning on the exterior.

During renovation of these areas, care should be taken not to sand, grind or abrade surfaces coated with LBPs. SCI recommends that any disturbance of these painted surfaces must be performed by workers that are renovation, repair and paint program (RRP) trained. If the painted building components are to remain and be refinished, then stripping the paint should be performed by a licensed abatement contractor. If the components are to be removed then they can be removed by RRP-trained workers with appropriate safety training and disposed as construction waste. There are no special disposal considerations in Missouri for disposal of demolition rubble from this structure as long as it is disposed in a licensed solid waste landfill.

We appreciate the opportunity to be of service to you on this project. If you have any questions or comments regarding these results, please feel free to contact us.

Respectfully,

SCI ENGINEERING, INC.

Jessica Keeven

Jessica B. Keeven, CHMM
Senior Scientist

JBK/EPG/rah

Enclosures
XRF Results

XRF Results
Mexico Readiness Center (T2318-01)
Mexico, Missouri
SCI No. 2023-1922.27

Reading No	Substrate	Component	Room	Side	Color	Paint Result	Pb	Pb 2-Sigma
6	Neg Cal					Pass	<LOD	0.01
7	Pos Cal					Inconclusive	0.8091	0.1
8	Pos Cal					Inconclusive	0.8336	0.1
9	Pos Cal					Inconclusive	0.8178	0.1
10	Pos Cal					Fail	1.0107	0.1
11	Pos Cal					Fail	0.9886	0.1
12	Metal	Wall	Ordanace	B	Grey	Pass	0.0888	0.0283
13	Metal	Wall	Ordanace	A	Grey	Pass	<LOD	0.01
14	Metal	Door Frame	Ordanace	D	Grey	Pass	0.0559	0.0233
15	Metal	Door Frame	Ordanace	D	Brown	Pass	0.0554	0.0363
16	Metal	Door	Ordanace	A	Grey	Pass	0.0691	0.0304
17	Metal	Door	Ordanace	A	Brown	Pass	0.249	0.0588
18	Metal	Floor	Ordanace		Grey	Pass	0.0507	0.0222
19	Concrete	Floor	Ordanace		Grey	Inconclusive	0.0406	0.0223
20	Block	Wall	Unit Storage	A	Grey	Pass	<LOD	0.01
21	Block	Wall	Unit Storage	A	White	Pass	<LOD	0.01
22	Wood	Wall	Unit Storage	D	White	Pass	<LOD	0.01
23	Block	Wall	Unit Storage	B	Grey	Pass	<LOD	0.01
24	Block	Wall	Unit Storage	C	White	Pass	<LOD	0.01
25	Wood	Wall	Office 1	B	White	Pass	<LOD	0.01
26	Block	Wall	Office 1	D	White	Pass	<LOD	0.01
27	Wood	Wall	Office 1	B	White	Pass	<LOD	0.01
28	Concrete	Floor	Office 1		Grey	Pass	<LOD	0.01
29	Concrete	Floor	Office 1		Grey	Pass	<LOD	0.01
30	Block	Wall	Mech room	B	White	Pass	<LOD	0.01
31	Block	Wall	Mech room	D	Grey	Pass	<LOD	0.01
32	Block	Wall	Mech room	D	Blue	Pass	0.0551	0.0214
33	Brick	Wall	Locker room	B	Green	Fail	2.6883	0.2662
34	Metal	Vent cover	Locker room	B	Red	Pass	0.0381	0.0145
35	Brick	Wall	Locker room	A	Green	Fail	2.601	0.2532
36	Brick	Wall	Mens bath	B	Green	Fail	2.7912	0.2024
37	Brick	Wall	Mens bath	D	Green	Fail	2.6269	0.2584
38	Brick	Wall	Custodial	D	Blue	Pass	0.0896	0.0429
39	Brick	Wall	Custodial	A	Blue	Pass	0.1155	0.0148
40	Block	Wall	Custodial	B	Grey	Pass	0.0195	0.01
41	Brick	Wall	Womens bath	B	Tan	Fail	2.7645	0.2733
42	Brick	Wall	Womens bath	D	Tan	Fail	2.8485	0.2649
43	Block	Wall	Kitchen	B	White	Pass	<LOD	0.01
44	Block	Wall	Kitchen	A	White	Pass	<LOD	0.01
45	Block	Wall	General 1	C	White	Pass	<LOD	0.01
46	Drywall	Wall	General 1	C	White	Pass	<LOD	0.01
47	Wood	Wall	General 1	A	White	Pass	<LOD	0.01
48	Block	Wall	General 2	C	White	Pass	<LOD	0.01
49	Drywall	Wall	General 2	A	White	Pass	<LOD	0.01
50	Block	Wall	Conference	B	White	Pass	<LOD	0.01
51	Block	Wall	Conference	A	White	Pass	<LOD	0.01
52	Wood	Wall	Office 2	C	White	Pass	<LOD	0.01
53	Wood	Wall	Office 2	B	White	Pass	<LOD	0.01

XRF Results
Mexico Readiness Center (T2318-01)
Mexico, Missouri
SCI No. 2023-1922.27

Reading No	Substrate	Component	Room	Side	Color	Paint Result	Pb	Pb 2-Sigma
54	Drywall	Wall	Office 3	D	White	Pass	<LOD	0.01
55	Block	Wall	Office 3	C	White	Pass	<LOD	0.01
56	Drywall	wall	Office 4	D	Blue	Pass	<LOD	0.01
57	Block	Wall	Office 4	B	Blue	Pass	<LOD	0.01
58	Block	Wall	Lobby	C	White	Pass	<LOD	0.01
59	Block	Wall	Lobby	B	White	Pass	<LOD	0.01
60	Block	wall	Office 5	C	Tan	Pass	<LOD	0.01
61	Block	Wall	Office 5	B	Tan	Pass	<LOD	0.01
62	Block	Wall	Office 6	A	Tan	Pass	<LOD	0.01
63	Block	Wall	Office 6	B	Tan	Pass	<LOD	0.01
64	Block	wall	Office 7	C	tan	Pass	<LOD	0.01
65	Block	Wall	Office 7	B	Tan	Pass	<LOD	0.01
66	Brick	Wall	Classroom 1	D	Blue	Pass	0.3342	0.1
67	Drywall	Wall	Classroom 1	C	Blue	Pass	<LOD	0.01
68	Wood	Wall	Classroom 1	A	Blue	Pass	<LOD	0.01
69	Block	Wall	Classroom 2	D	Blue	Pass	<LOD	0.01
70	Wood	Wall	Classroom 2	A	Blue	Pass	<LOD	0.01
71	Drywall	Wall	Classroom 2	C	Blue	Pass	<LOD	0.01
72	Wood	Wall	Chair	A	Blue	Pass	<LOD	0.01
73	Block	Wall	Chair	B	Blue	Pass	<LOD	0.01
74	Block	Wall	General 3	D	Blue	Pass	<LOD	0.01
75	Wood	Wall	General 3	C	Blue	Pass	<LOD	0.01
76	Block	Wall	General 4	B	Blue	Pass	<LOD	0.01
77	Wood	Wall	General 4	A	Blue	Pass	<LOD	0.01
78	Wood	Door frame	Unit Storage	C	White	Pass	<LOD	0.01
79	Metal	Door	Unit Storage	B	White	Pass	<LOD	0.01
80	Metal	Window Sill	Office 1	C	Black	Pass	<LOD	0.01
81	Metal	Window	Office 1	C	Black	Pass	<LOD	0.01
82	Metal	Door frame	Office 1	B	White	Pass	0.0857	0.0363
83	Metal	Door	Office 1	A	White	Pass	<LOD	0.01
84	Metal	Door	Office 1	D	Grey	Pass	<LOD	0.01
85	Metal	Door frame	North Entry	C	Grey	Pass	<LOD	0.01
86	Metal	Door	North Entry	C	Grey	Pass	0.08	0.0394
87	Metal	Door Jam	Mech room	C	Green	Pass	0.0283	0.0163
88	Metal	Door frame	Mech room	C	Grey	Pass	0.1124	0.0249
89	Metal	Door frame	Locker room	C	Grey	Pass	0.1033	0.0266
90	Metal	Cage	Locker room	C	Black	Pass	<LOD	0.01
91	Metal	Window	Locker room	C	Black	Pass	<LOD	0.01
92	Metal	Door frame	Locker room	A	Green	Pass	0.2951	0.042
93	Metal	Window	Mech room	C	Black	Pass	<LOD	0.01
94	Metal	Door frame	Mens bath	B	Grey	Pass	<LOD	0.01
95	Metal	Door frame	Mens bath	C	Green	Pass	0.1772	0.0423
96	Metal	Window	Mens bath	D	Black	Pass	<LOD	0.01
97	Metal	window	Mens bath	D	Black	Pass	<LOD	0.01
98	Metal	Door frame	Custodial	B	Grey	Pass	0.0515	0.0233
99	Metal	Door frame	Womens bath	D	Grey	Pass	<LOD	0.01
100	Metal	Window	Womens bath	D	Black	Pass	<LOD	0.01
101	Metal	Door frame	Kitchen	B	Tan	Pass	0.2252	0.0412

XRF Results
Mexico Readiness Center (T2318-01)
Mexico, Missouri
SCI No. 2023-1922.27

Reading No	Substrate	Component	Room	Side	Color	Paint Result	Pb	Pb 2-Sigma
102	Metal	Window	Kitchen	D	Black	Pass	<LOD	0.01
103	Metal	Sill	Kitchen	D	Tan	Pass	<LOD	0.01
104	Metal	Door frame	Kitchen	D	Tan	Pass	<LOD	0.01
105	Metal	Door	Kitchen	D	Tan	Pass	<LOD	0.01
106	Block	Wall	Kitchen	A	Red	Pass	<LOD	0.01
107	Metal	Door frame	General 1	B	Grey	Pass	0.0639	0.0203
108	Metal	Window	General 1	D	Black	Pass	<LOD	0.01
109	Metal	Door frame	General 2	B	Grey	Pass	0.0959	0.0411
110	Metal	Window	General 2	D	Black	Pass	<LOD	0.01
111	Metal	Door jam	General 2	B	Blue	Pass	<LOD	0.01
112	Metal	Door frame	Storage	D	Black	Pass	<LOD	0.01
113	Metal	Door frame	Conference	C	White	Pass	0.195	0.0898
114	Metal	Door frame	Conference	A	Grey	Pass	0.0781	0.0384
115	Metal	Window	Conference	A	Black	Pass	<LOD	0.01
116	Stone	Window Sill	Conference	A	White	Pass	<LOD	0.01
117	Metal	Door frame	Conference	D	Grey	Pass	0.1875	0.0648
118	Metal	Door frame	Office 2	A	Grey	Pass	0.2039	0.0666
119	Metal	Window	Office 2	A	Black	Pass	<LOD	0.01
120	Wood	Window Sill	Office 2	A	White	Pass	<LOD	0.01
121	Metal	Door frame	Office 3	A	Grey	Pass	0.2471	0.0821
122	Metal	Window	office 3	A	Black	Pass	<LOD	0.01
123	Metal	Window	Office 4	A	Black	Pass	<LOD	0.01
124	Metal	Door frame	Office 4	A	Grey	Pass	0.1338	0.0584
125	Metal	Door frame	Lobby	A	White	Pass	0.0754	0.0219
126	Metal	Door frame	Lobby	A	White	Pass	<LOD	0.01
127	Metal	Door frame	Lobby	A	Black	Pass	<LOD	0.01
128	Metal	Door	Lobby	A	Black	Pass	<LOD	0.01
129	Metal	Door frame	Office 5	C	Grey	Pass	0.1082	0.0544
130	Metal	Window	Office 5	A	Black	Pass	<LOD	0.01
131	Metal	Door frame	Office 5	B	Grey	Pass	0.1032	0.0523
132	Metal	Window	Office 6	A	Black	Pass	<LOD	0.01
133	Metal	Door frame	Office 6	B	Grey	Pass	0.1013	0.0465
134	Metal	Window	Office 7	A	Black	Pass	<LOD	0.01
135	Metal	Door frame	Office 7	C	Grey	Pass	0.1447	0.0303
136	Metal	Door frame	Classroom 1	D	Black	Pass	0.0644	0.0275
137	Metal	Door frame	Classroom 2	D	Grey	Pass	0.0845	0.0201
138	Metal	Door frame	Classroom 2	C	Grey	Pass	<LOD	0.01
139	Metal	Door frame	General 3	D	Grey	Pass	0.0641	0.0337
140	Metal	Door frame	General 4	D	Grey	Pass	0.0641	0.0232
141	Epoxy	Door	Genral 4	D	Grey	Pass	0.2118	0.052
142	Epoxy	Floor	Classroom 1		Grey	Pass	<LOD	0.01
143	Epoxy	Floor	Classroom 2		Grey	Pass	<LOD	0.01
144	Epoxy	Floor	Mech room		Grey	Pass	<LOD	0.01
145	Epoxy	Floor	General 3		Grey	Pass	<LOD	0.01
146	Epoxy	Floor	General 4		Grey	Pass	<LOD	0.01
147	Block	Wall	Drill	B	BLack	Pass	<LOD	0.01
148	Block	Wall	Drill	B	Black	Pass	<LOD	0.01
149	Block	Wall	Drill	A	White	Pass	<LOD	0.01

XRF Results
Mexico Readiness Center (T2318-01)
Mexico, Missouri
SCI No. 2023-1922.27

Reading No	Substrate	Component	Room	Side	Color	Paint Result	Pb	Pb 2-Sigma
150	Block	Wall	Drill	D	white	Pass	<LOD	0.01
151	Stuco	Wall	Drill	A	Black	Pass	<LOD	0.01
152	Metal	Window	Exterior	A	WHite	Pass	<LOD	0.01
153	Stuco	Wall	Exterior	D	Black	Pass	<LOD	0.01
154	Metal	Window	Exterior	D	Red	Pass	<LOD	0.01
155	Metal	Pole	Exterior	D	Red	Fail	4.7564	0.2399
156	Metal	Pole	Exterior	D	Red	Fail	4.6432	0.2417
157	Metal	Awning	Exterior	D	Tan	Fail	2.2458	0.2189
158	Metal	Door frame	Exterior	D	Tan	Pass	<LOD	0.01
159	Metal	Door	Exterior	D	White	Pass	<LOD	0.01
160	Brick	Wall	Exterior	A	White	Pass	<LOD	0.01
161	Brick	Wall	Exterior	A	Grey	Pass	<LOD	0.01
162	Metal	Door frame	FMS Office	A	Grey	Pass	<LOD	0.01
163	Metal	Door	FMS Office	A	Grey	Pass	<LOD	0.01
164	Metal	Door	FMS Office	C	Grey	Pass	0.0688	0.0347
165	Metal	Door frame	FMS Office	C	WHite	Pass	0.0178	0.0127
166	Block	Wall	FMS Office	C	White	Pass	0.0563	0.0217
167	Block	Wall	Bay 1	D	Grey	Pass	0.1384	0.0444
168	Block	Wall	Bay 1	D	Black	Pass	0.0255	0.0104
169	Block	Wall	Bay 1	C	White	Pass	0.2223	0.016
170	Block	Wall	FMS equip	C	White	Pass	<LOD	0.01
171	Block	Wall	FMS bath	B	White	Pass	<LOD	0.01
172	Block	Wall	FMS storage 1	B	White	Pass	0.0245	0.015
173	Block	Wall	FMS storage 2	A	White	Pass	0.0147	0.0112
174	Block	Wall	FMS storage 2	A	Grey	Pass	0.1106	0.0351
175	Block	Wall	FMS storage 2	B	Red	Pass	0.0951	0.0105
176	Block	Wall	Bay 2	B	White	Pass	0.2172	0.0907
177	Block	Wall	Bay 2	B	Grey	Pass	0.0742	0.0292
178	Block	Wall	Bay 2	B	Red	Pass	0.2494	0.052
179	Metal	Door frame	Bay 2	D	Yellow	Pass	<LOD	0.01
180	Block	Wall	Bay 2	D	White	Pass	0.1277	0.0228
181	Metal	Door	Cold storage	D	White	Pass	0.0128	0.01
182	Metal	Beam	Cold storage	D	Brown	Pass	<LOD	0.01
183	Metal	Wall	Cold storage	D	White	Pass	<LOD	0.01
184	Metal	Beam	Cold storage	D	Brown	Pass	<LOD	0.01
185	Metal	Cage	Cold storage		Black	Pass	0.0431	0.0124
186	Metal	Cage	Cold storage		Black	Pass	0.0139	0.01
187	Metal	Cage	Cold storage		Black	Pass	0.014	0.0108
188	Neg Cal					Pass	<LOD	0.01
189	Pos Cal					Fail	0.8144	0.1

APPENDIX C

GEOTECHNICAL - TESTING LAB
1000 W Nifong Blvd.; Building 1
Columbia, Missouri 65203
(573) 447-0292

April 12, 2024

SOA Architecture
2801 Woodard Drive, #103
Columbia, Missouri 65202

Attn: Ms. Jen Hedrick

Re: Mexico Readiness Center Floor Issue Evaluation
Mexico, Missouri
Crockett GTL Project Number: C24041

Dear Ms. Hedrick:

At your request, Crockett Geotechnical - Testing Lab (CGTL) has conducted a site reconnaissance and a limited geotechnical investigation for the Mexico Readiness Center that is experiencing floor slab distress in portions of the structure.

The purpose of our investigation was to:

- identify the cause of floor slab movement; and
- provide recommendations for floor slab repair.

Geotechnical Considerations

To achieve this purpose Crockett GTL removed two sections of slab approximately 24 inches in diameter in the locker room and general use room. Based on these two sections, the existing slab consists of 4 inches of concrete underlain by 6 inches of gravel. The soils underlying the gravel at both locations were evaluated with a steel T-probe, hand penetrometer, and nuclear field density gauge. In addition, samples were obtained to perform swell tests on in general accordance with ASTM D4546. Based on our limited field testing, the underlying soils consisted of wet, shaley, lean clay soils with hand penetrometer readings ranging from 1,000 psf to 1,500 psf.

The results of the swell tests with a surcharge pressure of 60 psf were 2.0% and 0.9%. Literature indicates swell greater than 1.5% is considered high, or critical. Swell less than 0.5% is considered low or non-critical. Swell on the order of 0.5% to 1.5% is considered marginal.

Because of the measured swell potential of the near surface soils, *continued* differential movement of lightly loaded, grade supported structures (i.e. floor slabs) is possible.

Findings

It is our professional opinion the floor slab movement is related to the presence of shrink/swell prone soils below the floor slab. The swell tests support this conclusion. In addition, the soils and gravel supporting the floor slab were wet. Such soils are commonly referred to as ˝expansive˝ or ˝swelling˝ soils because they expand or swell as their moisture content increases. However, these soils also ˝contract˝ or ˝shrink˝ as their moisture content decreases. Footings, floor slabs and pavements supported on expansive soils will experience cycles of upward and downward movement that will result in distortion, possibly causing cracking or structural damage to the structure.

The severity of cracking and other cosmetic and structural damage will likely increase if any modification of the site results in excessive wetting or drying of the on-site expansive soils. Eliminating all of the risk of movement and distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during repair.

Repair Options

Prior to implementing any repair scenario, we recommend all water lines and drain lines be tested or inspected to determine if any leaks exist. Any such leaks could provide a source of water that would trigger additional subgrade movement and should be repaired immediately. Regular future inspections of subsurface utilities is recommended.

Several options could be considered to reduce the magnitude and/or the impact of future floor movements due to heave or shrinkage from the causes described above. These options are discussed below:

- *Accept Future Heave and Reduce Impacts:* This option would involve leaving the existing floor slab in place and accepting the future heave or shrink that may occur. This would eventually result in a more warped and undulating floor slab. Buckling of the slab could also eventually occur if maximum heave potentials are realized. Under-slab piping could also be damaged as a result of the heave.

  Drains should also be installed around the perimeter of the structure if not already in place. The potential effectiveness of drains would be impacted by the surrounding soil type, surface grading, intercepting runoff from downspouts and water spigots, etc.

  Further, all grades must provide effective drainage away from the building. Grades around the structure should be checked and adjusted, as necessary, as part of the structure´s

maintenance program. Water permitted to pond next to the building can result in greater soil movements than those discussed in this report.

Reduce Future Floor Slab Movements: Future floor slab heave can be reduced by modifying the existing expansive soil subgrade by removing the floor slab and the upper 24-inches of soil below the floor slab and replacing with 24 inches of low volume change material.

Chemical treatment was also considered but, after consulting with a soil stabilization contractor, it is our understanding that no equipment is available for chemical treatment of soil in confined spaces.

We appreciate the opportunity to be of service and look forward to working with you during the construction phase of this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

Eric H. Lidholm, P.E.
Principal Engineer

Shane Steinman, P.E.
Project Engineer
Missouri: PE-2017000376

Enclosures

cc: 1 – Client (.PDF)
1 – File

CROCKETT
GEOTECHNICAL - TESTING LAB

One-Dimensional Swell Potential of Cohesive Soils
ASTM D 4546

Client Name: State of Missouri
Project Name: Mexico Readiness Center
Project Location: Mexico , MO

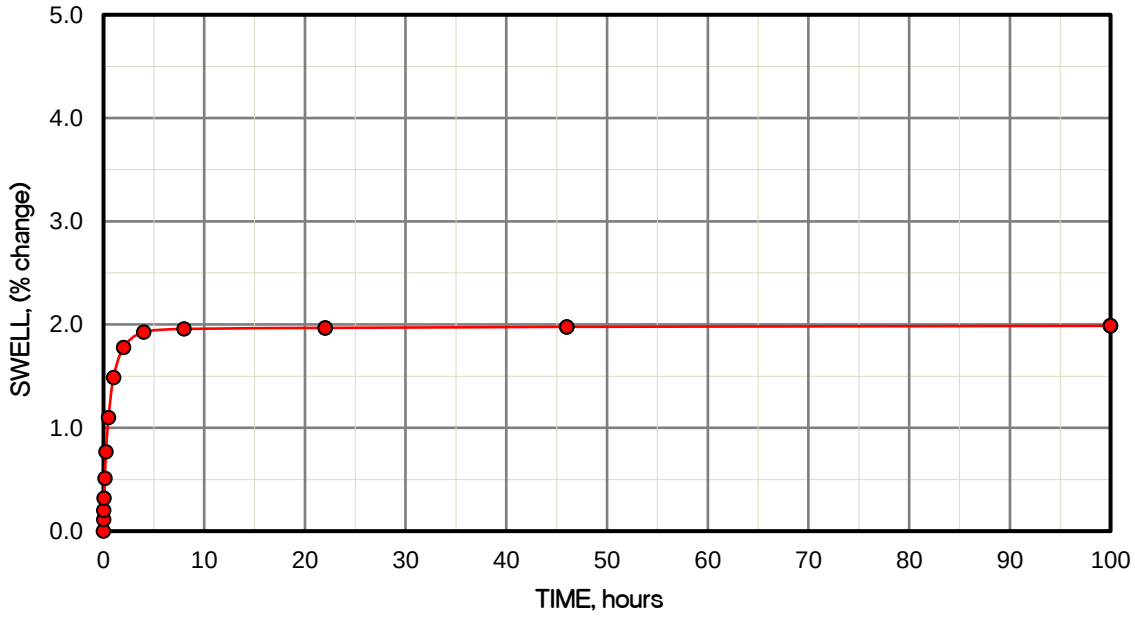
Project No.: C24041 Date: 4/12/24

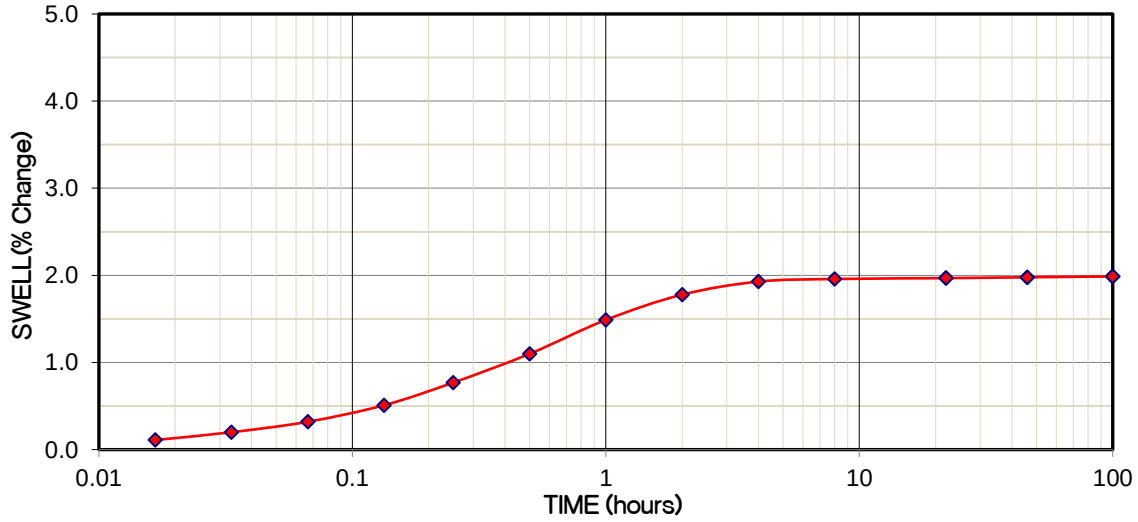
TEST RESULTS
SWELL: 2.0 %

Boring Number: N/A Sample No.: 1
Sample Date: 3/26/24 Depth (ft): 1
Sample Description: LEAN CLAY: Gray, trace shale, shaley texture

Test Procedure: ASTM D 4546, Method B
Reviewed by: Eric H. Lidholm, P.E.

Liquid Limit: 32
Plastic Limit: 17
Plasticity Index: 15 *(NP = Non Plastic)*
Initial Moisture Content: 12.0 %
Initial Dry Density: 111.6 pcf
Surcharge Pressure: 60 psf
Final Moisture Content: 15.8 %
Final Dry Density: 109.5 pcf





CROCKETT
GEOTECHNICAL - TESTING LAB

One-Dimensional Swell Potential of Cohesive Soils
ASTM D 4546

Client Name: State of Missouri
Project Name: Mexico Readiness Center
Project Location: Mexico , MO

Project No.: C24041 Date: 4/12/24

TEST RESULTS
SWELL: 0.9 %

Boring Number: N/A Sample No.: 2
Sample Date: 3/26/24 Depth (ft): 1
Sample Description: LEAN CLAY: Gray, trace shale, shaley texture

Test Procedure: ASTM D 4546, Method B
Reviewed by: Eric H. Lidholm, P.E.

Liquid Limit: 35
Plastic Limit: 18
Plasticity Index: 17 *(NP = Non Plastic)*
Initial Moisture Content: 12.6 %
Initial Dry Density: 114.9 pcf
Surcharge Pressure: 60 psf
Final Moisture Content: 17.7 %
Final Dry Density: 110.1 pcf